THURSDAY, AUGUST 9, 1888.

THE ZOOLOGICAL RESULTS OF THE "CHALLENGER" EXPEDITION.

Report on the Scientific Results of the Voyage of H.M.S. "Challenger" during the Years 1873-76, *under the command of Captain George S. Nares, R.N., F.R.S., and the late Captain Frank T. Thomson, R.N.* Prepared under the superintendence of the late Sir C. Wyville Thomson, Knt., F.R.S., and now of John Murray, one of the Naturalists of the Expedition. Zoology—Vols. XXIII., XXIV., and XXV. (Published by Order of Her Majesty's Government, 1888.)

THE first two memoirs in Vol. XXIII. are Reports on the Pteropoda by Dr. Paul Pelseneer. Dr. Pelseneer's Report on the Gymnosomatous division of the Pteropods was published in Vol. XIX., and we now have his Report on the Thecosomata and one on the anatomy of the whole group.

In the first of these Reports all the certainly genuine species at present described are enumerated, and full details are given about all those which have been more or less imperfectly described. As the diagnoses of the families and genera of the Pteropods seem to have been copied from originals of a comparatively early date and without modification, it has been necessary on re-study to re-write these, so as to bring them up to the level of scientific accuracy. This monographic study of the sub-group of the Thecosomata has been based not only on the collections made by the *Challenger*, but on those in the British and Brussels Museums, as well as those of several private collections. Like the Gymnosomata, these Thecosomata are pelagic Mollusks, which descend to certain depths to avoid too bright a light, and reascend to the surface of the water when the light is feeble or absent, and when the sea is calm. With a less highly organized alimentary system than the Gymnosomata, the Thecosomata content themselves with humble prey, feeding mainly on Radiolaria, Foraminifera, Infusoria, and even on some of the lower Algal forms.

The Thecosomata were taken alive at seventy different stations, and while they include twenty-eight species, representing all the known genera, they have all been already described. Of those dredged from the deep sea, where "Pteropod ooze" was found, some twenty-four species could be distinguished, of which one was new to science. The total number of Thecosomata now known amounts to forty-two.

While the generic titles given to living forms amount to thirty-four, these can well be included, according to the author, in the following eight:—

Limacina, Cuvier.	Cavolinia, Abildgaard.
Peraclis, Forbes.	Cymbulia, Peron and Lesueur.
Clio, Linn.	Cymbuliopsis, gen. nov.
Cuvierina, Boas.	Gleba, Forskal.

In an appendix to the account of the species of the first two of these genera, some account is given of the forms described by A. Adams as *Agadina stimpsoni*, and *A. gouldi*, which are proved to be Gastropod larvæ.

Shells of Thecosomata have not been found in a greater depth than 1950 fathoms. Mr. J. Murray attributes this to the greater proportion of carbon dioxide in the water at greater depths, and to the more rapid solution of the delicate shells in sea-water under great pressure.

The third part of Dr. Pelseneer's Report treats of the anatomy of the whole of the Pteropods. With it this Report is now the most comprehensive treatise in existence on the group. As a result of his studies he regards the Pteropods as forming not a primitive group, but, on the contrary, a recent and specialized one—a terminal group. There are in it but a small number of species; these exhibit only a slight variability, and they are profoundly modified in adaptation to a special mode of existence.

Since the days of Cuvier the Pteropoda have been regarded as forming a distinct class among the Mollusca, of the same value as the Cephalopoda, Gastropoda, &c.; but Dr. Pelseneer regards it as proved that they are but Gastropods, in which the adaptation to pelagic life has so modified their external characters as to give them an apparent symmetry; that even among the Gastropods they do not constitute a distinct sub-class, nor even an order, that they belong to the Euthyneura, and among these to the Pectibranchiate Opisthobranchs, differing less from these than they differ from the other Opisthobranchs. The Thecosomata and Gymnosomata are two independent groups, not having a common origin, the former having descended from the Bulloidea, and the latter from the Aplysioidea.

These Reports are illustrated with seven plates.

The third Report in this volume is by Prof. G. J. Allman, forming the second part of his memoir on the Hydroida. The author has taken advantage of the opportunity afforded by the typical character of the collection to make it the basis of a general exposition of Hydroid morphology, and this from the present standpoint of our knowledge, so that this Report is not a mere mass of descriptive and distributional details, but one which will have an abiding interest for the biologist.

The rare occurrence in the collection of British species is striking, and would seem to indicate a peculiar definiteness in the geographical distribution of the Hydroids.

The few Gymnoblastic Hydroids in the collection belong to three genera—Stylactis, Eudendrium, and Monocaulos; the species (*M. imperator*), by which the last genus is represented, being perhaps the most remarkable Hydroid obtained during the Expedition. The stem, though only half an inch in thickness, was 7 feet in height, the hydranth extending, from tip to tip of the tentacles, to a width of 9 inches, so that, as regards size, all other Hydroids sink into insignificance when compared to it; while the depth of about 4 statute miles from which it was brought up adds to the special interest of this marvellous animal.

The families of the Calyptoblastea were numerously represented in the collection, and among those of which few examples had hitherto been known are those to which belong the genera Cryptolaria and Grammaria, as well as a new and interesting genus, Perisiphonia. Idia hitherto only known by the poor description and figure of Lamouroux, proved, on the examination of good specimens of the only species, *I. pristis*, Lamx., to be constructed on a type quite unique among the Hydroida.

Among other families largely represented was that of the Haleciidæ, with not only many new species, but with a new genus, marked by the phenomenon that the colony is provided with bodies which admit of close comparison with the sarcostyles and sarcothecæ of the Plumularinæ.

The curious genus Synthecium, in which the gonangia spring from within the cavity of the hydrotheca, is represented by two new species, both from the Australian seas. There also occur fine examples of the remarkable genus Thecocladium, in which every branch of the colony springs, like the gonangium in Synthecium, from within the cavity of the hydrotheca.

As regards the classification of the Hydroida, the author acknowledges that the time for a complete system has not yet come, such a one should include not only all Hydroid trophosomes with their associated gonosomes; but all the existing Hydromedusæ should have been traced to their respective trophosomes, there are however many of these Hydromedusæ not so traced, though we may be certain that their trophosomes exist. Of those Hydromedusæ into whose life history a polypoid term has never apparently been intercalated, a separate and well defined group must be formed. Thus the sub-orders may be neatly defined as :—(1) *Gymnoblastea*. No hydrothecæ or gonangia. Nutritive zooids when more than one forming permanent colonies Planoblasts in the form of Anthomedusæ. (2) *Calyptoblastea*. Hydranths protected by hydrothecæ. Sexual buds protected by gonangia. Nutritive zooids forming permanent colonies. Planoblasts in the form of Leptomedusæ. (3) *Eleutheroblastea*. No hydrothecæ or gonangia. Nutritive zooids not forming permanent colonies. No differentiated gonophores. (4) *Hydrocorallia*. A calcareous corallum (cœnosteum) permeated by a system of ramified and inosculating cœnosarcal tubes from which the hydranths are developed. (5) *Monopsea*. Free Hydromedusæ which are developed directly from the egg without the intervention of a polypoid trophosome. Auditory clubs with endodermal otolites on the umbrella margin, and (6) *Rhabdophora* (Graptolites). Hydranths replaced by sarcostyles. Hydrocaulus traversed by a chitinous longitudinal rod.

Thirty-nine plates accompany this portion of Prof. Allman's memoir, the enlarged figures on these are all from the pencil of the author, while the figures representing the forms of their natural size have been for the most part drawn from the specimens by Miss M. M. Daniel, and transferred to the stone by Mr. Hollick.

The Report taken in connection with the previously published one on the legion of the Plumularinæ constitutes a most comprehensive and valuable history of the Hydroids for which all biological students will feel their indebtedness to the author.

The fourth Report is on the Entozoa, by Dr. O. von Linstow of Göttingen. The number of Entozoa collected was but small, and chiefly from the alimentary tract of birds; four new species of Ascaris, three of Filaria, and one of Prothelmins, among the Nematodes, four species of Tænia, and two of Tetrabothrium among the Cestoids, are described and figured in the two plates accompanying the Report.

The fifth Report, also a short one, is by Edgar A. Smith, on the Heteropoda. Although no new species are described, several are indicated of which the material was not sufficient to enable the form to be described with certainty.

A most useful and wonderfully complete synonymic list of all known forms of the group is given, and this Report will be found of the greatest value to all interested in the Heteropods.

Vol. XXIV. contains the Report, by C. Spence Bate, F.R.S., on the Crustacea Macrura, or rather on the larger portion of those found during the Expedition. This Report forms a volume of over 1030 pages, which is bound up separately from the 157 lithographic plates; and in the preparation of this great and laborious work and its illustrations Mr. Spence Bate has occupied all his leisure during the last ten years.

Of the enormous mass of detail in this volume it would be impossible to give within our limits any intelligible account; not only are the generic and specific diagnoses given with minute accuracy, but we are, in addition, favoured with a deeply interesting account of all that is known as to the developmental stages of the species; for this latter purpose the notes and drawings from life of the late Dr. Willemoes Suhm have been largely and most properly used. The extreme imperfection of the records of the life-history of even some of our well-known forms is strongly insisted upon, and we would call attention to the subject in the hope that we may direct the energies of some of our younger biologists to this fertile field of research.

The great and recognized experience of the author in all that concerns this section of the Crustacea makes his opinions, founded on so large a knowledge, as to the classification thereof, of importance. Accepting the divisions of this sub-order of the Decapods, called by Huxley Trichobranchiata and Phyllobranchiata, though with a slightly different arrangement of some of the families, the author follows Dana in placing the Penæidea in a separate division, with the name Dendrobranchiata, "while the Squillidæ, Mysidæ, &c.—that is, the Schizopoda originally, and later the Stomapoda of Latreille, Milne Edwards, and De Haan—are arranged under the head of Anomobranchiata, which term was first used by Dana and afterwards by Heller; it has therefore priority of date, and is less liable to misconception than the term Abranchiata" of Huxley (p. 6). Afterwards we find, on a review of the forms included under the Dendrobranchiata, that the Schizopoda may be regarded as an aberrant group of this tribe. Prof. Sars, who, it will be remembered, described the Schizopoda of the *Challenger* Expedition ("Zool. Reports," Part 37) thought "it more appropriate for the present to assign to this group the rank of a distinct tribe or sub-order, there being several well-marked characters distinguishing these Crustacea rather sharply from all other known Decapods." Mr. Spence Bate, however, thinks "that with the exception of the variable condition of the pereiopoda, the several genera do not possess a single character that is not held in common with some genus of the Macrura," and concludes from excellent reasons given in detail "that the natural position of these animals is that of an aberrant tribe of the Dendrobranchiata, more nearly allied to the degraded forms of the Penæidea than to those of any other group" (p. 472).

Each of the three divisions of the Macrura are divided

into two sections—the Aberrantia and the Normalia. In the former section of the Trichobranchiata the family Galathæidæ occurs, which will form the subject of a Report yet to appear by Prof. J. R. Henderson.

The group Aberrantia of the division Phyllobranchiata consists of several tribes and families that in their adult condition approach more nearly to the characters common to other divisions, but which nevertheless during the progress of development pass through a stage common to the normal Phyllobranchiate Macrura. This aberrant group has long been known to biologists under the name of Anomura, and by some has been regarded as a distinct order of Crustacea. Here it is however regarded as a group of the Phyllobranchiate division of the Macrura, "for undoubtedly in their earlier stages they pass through a morphological change that is essentially Macrurous, in which the scaphocerite and rhipidura are both present as well-devoloped appendages, the latter of which they never entirely lose."

This group will be reported on by Prof. John R. Henderson, although two new genera and several new species are described and figured in the present Report.

It only remains to mention that with the exception of two out of the 157 plates all have been lithographed from the original drawings of Mr. Spence Bate. By this fact the value of this Report is intensified, as the author has been able to describe and figure what he has seen with a clearness and distinctness which far surpasses in effect the most brilliant work of the cleverest of artists. In an appendix Dr. Hoek gives a description, with figures, of *Sylon challengeri*, a new parasite Cirriped.

Vol. XXV. also contains but a single Report, that on the Tetractinellida, by Prof. W. J. Sollas. Perhaps no department of zoology has made during the last twenty years such rapid progress as the Sponges, and it is astonishing to think of the large number of forms that have been very fully examined during this period. Certainly no group has benefited more largely by the researches made during the expedition of the *Challenger*, and it was the greatest good fortune that the collections made were submitted to such excellent workers as Polejaeff, F. E. Schulze, Ridley, Dendy, and Sollas. The joint Reports of these authors, and the splendid series of illustrations which accompany them, form a complete history of this group up to the existing state of our knowledge, a history which shows the worker what is not known as well as what is.

The last of these Reports treats of the Tetractinellida, and in an appendix of a small group of Monaxonida, about the exact location of which there was for long some doubt. In its monographic completeness it surpasses all the other Reports on the Sponges, while in the fullness of its morphological details it may well serve as an introduction to a knowledge of all the orders.

The Tetractinellid Sponges of the *Challenger* having been well preserved, it was possible to make a thorough investigation of their minute anatomy, a work involving an enormous amount of labour in the cutting of thousands of thin sections, and the separate examination of most of them. The number of species and varieties obtained by the *Challenger* was 87, of which 73 are new to science. These are arranged in 38 genera, of which 18 are new. n addition there are 221 species mentioned, making the total number of described species 294, and of accepted genera 81.

Dividing the Sponges into the two classes of the Megamastictora (with the single sub-class Calcarea) and Micromastictora, the latter is divided into the three subclasses of Myxospongiæ (Halisarca, &c.), Hexactinellida, and Demospongiæ. The subdivision of this last may be made primarily into two tribes : (1) the Tetractinellida, (2) the Monaxonida. The former may be characterized as Demospongiæ in which some or all of the scleres are tetraxons, triænes, or desmas. The name Tetractinellida was first proposed by Marshall (1876) in practically the same sense as it is used now by Sollas.

Into the details of the sub-orders and families of this tribe our space forbids us to enter. Their descriptions, with those of the genera, will be found in orderly sequence in the introductory chapter, while the descriptions of the species occupy 410 pages of the Report.

In an appendix we have an account of the Sponges belonging to the Spintharophorous sub-order of the Monaxonida, which, under the impression that they were more nearly related to the Tetractinellida, had been omitted from Ridley and Dendy's Report of the Sponges of this tribe.

The figures of the Sponges on the forty-four chromolithographic plates accompanying the Report were drawn by the well-known artist, T. H. Thomas, R.C.A. The Sponge portraits are really beautiful studies from the originals. The figures representing structure were first traced by the author with the camera lucida, and were then drawn by Mr. Thomas direct from the preparation under the microscope.

MATTHEW FONTAINE MAURY.

A Life of M. F. Maury, U.S.N. and C.S.N. Compiled by his Daughter, Diana Fontaine Maury Corbin. (London : Sampson Low, 1888.)

A MEMOIR of the illustrious founder of the science of the physical geography and meteorology of the sea, written by the tender and loving hand of his daughter, cannot fail to be of interest, not merely to that section of thinkers and workers who are engaged in the branch of science which Maury especially cultivated and adorned, but to the larger world who appreciate, and are benefited by, the perusal of the biography of a man of powerful and vitalizing imagination, disinterested labour for the public good, self-denying patriotism, and indomitable perseverance.

Family memoirs are too often apt to degenerate into a mere panegyric of public and private virtues, coupled with a disinterment of private matters which an unbiassed stranger would have too much tact and modesty to expose, and which often destroy all the effects of the accompanying eulogy. Mrs. Diana Corbin has, fortunately, succeeded in avoiding these pitfalls, and by a judicious blending of history, correspondence, and extracts from lectures, has enabled the reader to form his own judgment of the merits and services of her renowned father.

Descended from the French Huguenots on one side, and the English Protestants on the other, Maury seems to have united in his own person the lively imagination we unconsciously associate with the former, together with

the somewhat austere and unflinching determination of the latter; and it was by the rare union of these two qualities that he was enabled to vivify the dry statistics which, until his arrival, lay buried in the log-books on the shelves of the Hydrographic Bureau at Washington, like the ooze at the bottom of the Atlantic.

An accidental fall from a tree, early in life, took him from the farm to school; and a subsequent fall from a stage-coach, which permanently crippled him, appears to have exercised a still greater effect on his career by diverting him from his active physical service in the American Navy, to the mental study of the scientific branches of the profession. His appointment to the Naval Office at Washington, mainly through the publication of his anonymous "Scraps from the Lucky-bag," on naval reform, led to its subsequent development into what is now the world-known National Observatory and Hydrographical Department of the United States. Here it was that he inaugurated his "sailing directions," and elaborated his famous "wind and current charts," the absolute commercial value of which, in shortening voyages, was soon universally recognized, though, as usually happens, most tardily by his own country, where, though a Bill for remunerating their author to the extent of £5000 appears to have been brought forward (unknown to Maury) in January 1855, in the following month he was virtually placed in official disgrace, by being retired from the Active Naval List and having his salary reduced to £300.

This manifest injustice to a man, whose mind, if not body, was actively engaged in the highest branches of naval service to his country, was, after persistent vindication of his rights, repaired in 1858, when he was promoted to the rank of Commander, with back pay from the time of his retirement.

While tabulating the observations for his charts, Maury fascinated the world by the publication of the "Physical Geography of the Sea and its Meteorology," a book which, although some of its conclusions—such as an open sea surrounding the North Pole, and the crossing of the winds at the calm belts—have been found to be untenable in the light of more recent facts and research, still remains substantially trustworthy, and certainly unequalled by any modern treatise embracing the same subjects. It would be difficult to adequately estimate the immense contemporaneous and subsequent value of such a work, written in the charming and enthusiastic style which characterized all its author's productions. The present writer traces with gratitude his first attraction to physical geography and meteorology to this delightful book, of which most truly it can be said, that it realized Matthew Arnold's ideal combination, "sweetness and light."

By this book, Maury not only taught the world, but he pleased it at the same time, and he accomplished this rare result, without pandering in any way to mere popular taste, or forsaking the platform of truth. His popularization of a subject until then hardly dreamed of as a science resulted in the greatest achievement of his life, viz. the assembly, chiefly through his instrumentality, of the International Meteorological Congress at Brussels, in 1853, which marked the commencement of the present co-operation of nations in the work of both marine and land meteorology. Regarding the latter, indeed, Maury uttered a prediction, on p. 350 of his "Physical Geography," to the effect that "the greatest move that can now be made for the advancement of meteorology is to extend this system of co-operation and research from the sea to the land, and to bring the magnetic telegraph regularly into the service of meteorology."

At the present time, when the old question between the "cyclonologists" so-called and the "aspirationists" seems likely to be renewed by M. Faye and some of his disciples, it is interesting to notice that Maury never accepted either the purely circular doctrine of Reid, or the purely radial theory of Espy, but agreed with Thom and Redfield in thinking that the wind in a true cyclone blows in spirals, and he gave excellent reasons for his belief.

Maury's study of marine meteorology and physical geography not merely aided commerce by shortening passages, but enabled him to give material assistance to the laying of the first Atlantic cable to Europe; and, in fact, it was to his prediction of the "telegraphic plateau," and acute suggestion of a cord instead of heavy cable for the deep-sea portion, that the ultimate success of this enterprise was mainly due. From the sea, Maury turned his attention to the Great Lakes and the land, and his ardent espousal of the cause of agricultural meteorology, and the lecturing tours he made on behalf of this subject in all parts of the States, not only led to the establishment of the present magnificent Weather Bureau of the United States, but incidentally to his own decease through the fatigue and exposure thus encountered.

Maury's early religious training and temperament appear to have exercised a large influence on his public and private life. His physical geography is illustrated by frequent extracts from the Book of Job, and is instinct with the same spirit which prompted and pervaded the memorable Bridgwater Treatises. The following extract from his address to the University of the South will indicate this phase of his mind:—

"Astronomy is grand and sublime, but astronomy overpowers with its infinities and overwhelms with its immensities. Physical geography charms with its wonders, and delights with the benignity of its economy. Astronomy ignores the existence of man; physical geography confesses that existence, and is based on the Biblical doctrine that the earth was made for man. Upon no other theory can it be studied—upon no other theory can its phenomena be reconciled."

The Civil War unfortunately destroyed the continuity of Maury's work at Washington, and altered the whole course of his subsequent life. Impelled by a spirit of pure patriotism towards the State of Virginia which had reared him, he threw up his post in the North, and devoted himself to the Southern cause. No one who reads the life before us, and his "vindication of the South and of Virginia" in the appendix, can doubt the pure unselfishness of his motives. He had everything to lose, and nothing to gain, from a material point of view, by his action, and well he knew it. Essentially a man of peace, and deeply attached to his work at Washington, we cannot but admire his voluntary resignation of all to a sense of duty.

His scientific abilities being directed into a new chan-

nel, led to the development of the electrical torpedo, by which he materially aided the South, and which he afterwards introduced into Europe, whither he was sent during the war, to purchase torpedo materials.

His subsequent connection with Mexico, and his scheme for emigrating Southerners thither, though designed with a view to ameliorate the condition of his countrymen, and to open up a grand country, was never approved of by his friends, was politically a mistake, and terminated abruptly with the abandonment of the country by the French, and the assassination of the Emperor Maximilian. After this he returned to England, and, ultimately, to a Professorship in Virginia.

All through his chequered life he maintained an unfaltering devotion to meteorology, and his latest efforts were directed to developing a comprehensive system of crop and weather reports throughout the States.

The perusal of this interesting book leaves us with a deep impression of the comprehensive grandeur and philanthropy of Maury's mind. A rare spirit of devotion to science, not merely for the pleasure it always affords its devotees, but for the good it could achieve in the service of man, pervaded his whole life, and the additional record here presented of work done and schemes initiated, will add fresh laurels to the imperishable fame of its subject. E. DOUGLAS ARCHIBALD.

OUR BOOK SHELF.

Pflanzen-Teratologie. Von Maxwell T. Masters, M.D., F.L.S. Ins Deutsche übertragen von Udo Dammer. (Leipzig: H. Haessel, 1886.)

IT will be satisfactory to English botanists to find that a translation of Dr. Masters's classical work on vegetable teratology has been called for in Germany. The present German edition is not, however, simply a translation, as it has received many additions from the hand of the author. The work is thus of interest to English as well as to German readers, for it constitutes the most complete account in any language of abnormal structures in plants. The great value of such a record of teratological facts will be admitted by all botanists, however much they may differ as to the morphological significance of these phenomena.

In the German edition, the number of figures in the text has increased from 218 to 243. As a few of the original woodcuts have been omitted, the number of new figures is somewhat greater than appears from the total increase. Besides the additional woodcuts, a lithographed plate has been added, drawn by the translator from original figures of Göschke and Magnus.

Some of the more important additions to the original work may here be noticed. At p. 35 a new section is introduced, on fasciation of the root, illustrated by a woodcut (Fig. 8) of the singularly fasciated aërial roots of *Aerides crispum*. Caspary's view that only a single growing point takes part in the formation of each fasciated root is cited.

Fig. 66 (p. 155) shows a proliferous male flower of a Begonia, in which the stamens are entirely absent, and replaced by flower-buds. The curious case of the development of flower-buds on the root in Pyrus is illustrated by Fig. 91, described at p. 188. A remarkable abnormality in a Fuchsia is shown in Fig. 98 (p. 208). Here two stamens (one simple and the other branched) have arisen in the axils of a pair of foliage-leaves, which are adherent to the inferior ovary. On p. 213 some figures have been added to further illustrate the formation of adventitious siliquæ in Cruciferæ in the interior of the normal fruit. In Figs. 131, 132, and 133 (p. 257) three interesting cases of regular peloria in orchids are shown.

A striking instance of pistillody of the stamens in a Begonia is figured on p. 353 (Fig. 178). In this flower the stamens were replaced by open carpels each bearing a large number of marginal ovules. A conspicuous abnormality in an Anthurium is shown in Fig. 204 (p. 411), under the head of "Polyphylly." Here a great number of large foliaceous bracts are developed on the spadix, completely altering the character of the inflorescence.

Two instances of polyandry in an Odontoglossum are represented in Figs. 213 and 214 (p. 439). In the former of these cases all the six stamens of the typical Monocotyledonous flower are present.

It should be mentioned that the additional woodcuts are generally reproductions of figures originally published by the author in the *Gardener's Chronicle*. In the plate added by the translator the most interesting figures are perhaps those illustrating a remarkable series of abnormal forms of the foxglove, the number of parts in a whorl varying from one to fourteen, and the flower in many cases being actinomorphic instead of zygomorphic. These figures, like most of those on the plate, are taken from papers by Magnus.

It is much to be wished that the numerous observations on teratology accumulated by Dr. Masters and others since 1869 could be embodied in a new and complete English edition. Until this wish is realized, the present German edition is likely to remain the most extensive treatise on the subject. D. H. S.

Parish Patches. By A. Nicol Simpson. (Arbroath: Thomas Buncle, 1888.)

THIS volume consists of a series of short essays, each of which gives expression to the author's delight in some particular aspect of Nature. He presents no new ideas or observations, but he has so warm a love for what he calls the pastoral side of life, that most of his readers will find something to interest them in his glowing descriptions of scenes which appeal strongly to his sympathies. The work is well printed on good paper with wide margins, and it is carefully illustrated by engravings from drawings by Mr. John S. Fraser.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Functionless Organs.

I HAVE read with extreme interest the abstract, given in your number of July 26 (p. 310), of a paper by Prof. Ewart, on the "Structure and Development of the Electric Organ of *Raia radiata*." It bears upon a question of fundamental importance in biological science. Organic nature is full of organs, or of structures, which are either wholly or partly functionless. Sometimes they are called "aborted"; sometimes "degenerated"; sometimes "rudimentary"; sometimes "representative." But under whatever name, the Darwinian philosophy almost invariably explains them as structures, or parts of structures, which must have once been useful, and have become functionless by atrophy or disuse.

This is a natural and necessary consequence of the doctrine which ascribes all organic structures to utility as a physical cause. Utility as a mental purpose is kept out of sight. Utility in this last sense explains rudimentary structures by the uses or purposes which they are to serve in the future, or which, at least, they are capable of serving in the future. In this aspect rudimentary structures become "prophetic germs." But we

now know that Darwin denounced this interpretation of them, and saw that if the doctrine of prophetic germs could be established, his own theory would be reduced to rubbish.

Accordingly the more advanced Darwinians always consider functionless organs or structures as relics of a past in which they were useful. They are never interpreted as utilities which are yet to be.

I have always thought that if the doctrine of development be true, functionless organs must be, as often as not, the germs of potential use, and not necessarily at all the remains of past actual use.

What we want in this great question is physiological facts to indicate the one interpretation or the other. Hitherto I have never met with a case in which any expert interprets functionless organs as structures on the way to use. Perhaps no organ in any creature is more wonderful than the electric organs of certain fish. Any light cast upon their origin is a light cast on all organic apparatus. Here we have a case in which a distinguished physiologist detects, or thinks he can detect, an organ in process of being built up for the discharge of a very definite and peculiar function—a function for which it is not yet fit, or is but very imperfectly fitted.

This fact does not tell against development or evolution. But it does tell, and tells fatally, against the element of fortuity, which is inseparable from the idea of "natural selection," and to which Darwin attached so much importance, at one period of his life, and to which many of his disciples attach equal importance still. The fortuitous element is, in fact, the main ground on which they value it. But everywhere, in reasoning and in observation, it is breaking down. ARGYLL.

"Syrrhaptes paradoxus."

CONCERNING Prof. Newton's remark in NATURE, July 26, p. 295, on the occurrence of *Syrrhaptes paradoxus* in France, I beg to communicate that I picked the following dates out of several journals:—

May 28: On the sand-downs of Noirmoutier, Dieu, and Olonne, in the Vendée (several hundreds; three were killed).

May 31: Calais (ten specimens; one was killed).

Commencement of June: Nantes, Bretagne (one killed).

Middle of June: North of the country.

I am sure that we shall get much more news from France.

Dresden, August 2. A. B. MEYER.

Milk *v.* Fire.

IN Mr. Rust's note in NATURE, vol. xxxvii. p. 583, there is mention of a superstition that milk alone can extinguish a fire kindled by lightning—a belief that existed in Cambridgeshire, and which is entertained by the Sudan Arabs.

The Sinhalese (natives of Ceylon) have a similar belief in the efficacy of milk. When an epidemic such as small-pox breaks out in a village, two games of a religious character, *An-Edima* (horn pulling) and *Pol-gehlma* (striking cocoa-nuts together), are played in public for a couple of days. Then the Kapurála (lay priest), and those who have taken part in the games, go in procession with music, &c., to every house in the village, where arrangements have been made for the Kapurála's reception. The house and grounds are cleaned; the inmates wear newly-washed clothes; and portions of the ceiling and floor are covered with white cloths. A lamp is lit at the threshold of the building. The Kapurála carries an earthen pot containing either cocoa-nut milk or water medicated with saffron leaves, and over which charms have been pronounced. On his arrival at the door he chants a song about a fire in Madurápura (Madura, South India) which was quenched by the goddess Pattini with milk. He then pours the fluid from the earthern vessel upon the lighted lamp and extinguishes it.

The Sinhalese use the expression "May milk be poured on him [or her]," when desiring to avert from some one an impending calamity, or to counteract a curse or prophecy of evil pronounced against him.

The idea of employing milk to quench the fire of an epidemic (typified by the flame of a lamp), and the idea of the deity pouring milk on an individual in order to protect him from malignant influences, appear to be somewhat analogous to the belief that milk alone will extinguish a conflagration kindled by the fire from heaven. F. M. WICKRAMASINGHA.

Colombo Museum, Ceylon, June 30.

The Red Spot on Jupiter.

AN observation with my 10-inch reflector, power 252, on August 5, 1888, showed the red spot passing the planet's central meridian at about 7h. 48m. Comparing this with the first observation I obtained of this object during the present opposition, viz. on December 28, 1887, at 20h. 23m., I find that the rotation-period of the spot during the 220d. 11h. 25m. elapsed during the period referred to was 9h. 55m. 40·34s. (533 rotations), which is slightly less than what I derived from the preceding opposition, 1886–87, when the figures were 9h. 55m. 40·5s. (609 rotations).

If the entire interval is taken between observations secured here on November 23, 1886, and August 5, 1888 (embracing 620½ days), I find that the mean rotation-period has been 9h. 55m. 39·7s. (1500 rotations). This clearly proves that the velocity of the spot is increasing, for at the opposition of 1885–86 the period was 9h. 55m. 41·1s. (659 rotations), and it had been increasing since 1879, when it was only 9h. 55m. 34s. The inference now seems tenable that its accelerated motion may so reduce the rotation-period in a few years that it will return to the rate it had in 1879. There is also great probability that the spot is affected by cyclic variations, the period of which may be determined by further observations.

It is desirable to obtain views of the central passages of the red spot as late as possible in every opposition. A good telescope directed to the planet at the following times will show the spot very near its mid-transit:—

	h. m.		h. m.
Aug. 12	8 36	Sept. 8	6 2
17	7 45	15	6 51
24	8 34	20	6 0
29	7 43	27	6 49
Sept. 3	6 53	Oct. 2	5 58

The low position of Jupiter during the present year has somewhat hindered the successful observation of his more delicate features, and during the next opposition of 1889 the planet will be in 23° S. declination, so that the study of his surface ought to be undertaken in southern latitudes, where the conditions are more favourable. W. F. DENNING.

Bristol, August 6.

Circles of Light.

THE appearance described below was visible in Penrith and the surrounding district on Thursday, the 2nd inst., from 5 p.m. nearly till sunset. Round the sun as centre, at a distance of about 28°, about three-quarters of a circle of light were visible, the lowest quarter being absent. About a quarter of a circle of equal size touched this circle at its highest point. In the region of contact of the circles a space about 4° long and ½° broad seemed common to the two circles, as if they there overlapped, and this part was very bright, and bordered with red on the side towards the sun. The remaining parts of the circles were faint, and only to be seen when the disk of the sun was hidden by some obstacle; they were about ½° wide.

EDMUND CATCHPOOL.

Westleigh, Weston-super-Mare, August 6.

Michell's Problem.

THE issue of NATURE of July 19 (p. 272) contains a communication from Mr. Sydney Lupton on "Michell's Problem." I regret the author has not seen my paper on the same subject published in the *Philosophical Magazine*, November 1887, "On Random Scattering of Points on a Surface." The objections put forward by the late Prof. Forbes to the argument of Michell concerning the physical connection of double stars are there analyzed, and it is shown that the experiments by which Prof. Forbes assumed to invalidate it are on the contrary a very decisive experimental proof for and illustration of this argument. Mr. Lupton says, "The probability of exactly uniform distribution is *nil*. Michell, however, seems to assume this probability to be 1, or certainty." I fully agree with the former part of the statement. But never did Michell assume the obviously erroneous view on the distribution of stars ascribed to him by Mr. Lupton in the letter. It is true that it is a common error—not only of the ἀγεω μετρητοι—to confound random scattering with uniform distribution, but Michell has not fallen into this error.

London, August 3. JOSEPH KLEIBER.

Cloud Electric Potential.

UNDER the above heading, in NATURE of July 19 (p. 269), which has just come into my hands, Mr. E. Douglas Archibald criticizes a statement of mine in Part III. of "Deschanel," respecting electrified drops of water in a cloud. The following is the statement :—

"The coalescence of small drops to form large ones, though it increases the electrical density on the surfaces of the drops, does not increase the total quantity, and *therefore cannot directly influence the observed potential.*"

At the word "therefore" I give a reference to a previous section, in which it is shown that the potential at a point is the sum of all the quotients q/r, q denoting an element of the electricity to which the potential is due, and r the distance of this element from the point in question. Since the coalescence of drops is without effect on the value of each q and its corresponding r, it cannot affect any one of the quotients q/r, whose sum constitutes the potential.

Mr. Archibald's criticism is :—

"Surely this entirely omits the fact that the capacity of a sphere is equal to its radius, and thus, in the case of eight equal spheres coalescing into one, not merely would the density be doubled, but the potential of the *same quantity* would be increased *four times.*"

This criticism rests on two false assumptions :—

First, that the potential of a drop depends on its own charge only, and can therefore be computed by dividing its charge by its radius.

Secondly, that the potential of the drops (which on this supposition would be very different from the potential at a point midway between two drops) can be identified with "the observed potential."

J. D. EVERETT.

Cushendall, Co. Antrim, August 3.

THE ABSORPTION SPECTRA OF CRYSTALS.

ALL who are interested in the difficult work now going forward in so many chemical laboratories, in connection with the nature and constitution of those most complex mixtures known as "rare earths," and who recognize the extremely important influence which the solution of this subject must exert upon the very basis of our modern chemistry, will gladly welcome a new and exquisite means of investigation which M. Becquerel has recently brought to light.

As the reward of a most exhaustive study of the changes which are brought about in a beam of light by its passage through a crystal, M. Becquerel has discovered the key by means of which he is enabled to interpret the subtle indications which the issuing rays afford as to the nature of the molecules among which they have been threading their way. It appears at first sight more than wonderful that these delicate indications can have led to precisely the same weighty conclusions as those arrived at from the renowned physico-chemical researches of Auer von Welsbach, Lecoq de Boisbaudran, Demarçay, Soret, Crookes, and Krüss and Nilson. Yet such indeed is the case, and it even appears likely that the new method may be carried still further into the region beyond that which has up to the present been reached by these experimenters.

In order to explain the nature of this discovery, it will be necessary to describe the experimental steps which have led M. Becquerel towards it. In the year 1866 Bunsen found what now appears to be the germ of a great principle—that when a crystal of the sulphate of the substance didymium, now known to be a most complex mixture, was traversed by a beam of plane-polarized light vibrating at an angle of 20° to the horizontal diagonal of the crystal, the absorption spectrum was slightly different from that which was obtained when the ray was polarized in a plane at right angles. This observation did not attract much attention at the time, it being considered merely as a curious manifestation of the phenomenon of pleochroism.

Sorby, however, in 1869 again reopened the question, having found that in zircons the ordinary and extraordinary rays presented different bands of absorption. Since that time Becquerel himself has shown that the same applies to all birefractive crystals which give absorption spectra.

With so much premised, we are now in a position to consider the main results of this more recent investigation. They may be very briefly summarized as follows :—

(1) The bands in the absorption spectra of all crystals have fixed positions : the intensity alone varies with the direction of propagation of the light.

(2) In most crystals, the principal directions of absorption coincide with the directions of optical elasticity.

(3) In certain crystals the directions appear to be very different for different bands, but they always remain subject to the conditions imposed by the crystalline symmetry ; thus in monoclinic crystals one of the principal axes of absorption always coincides with the axis of symmetry, and the other two rectangular axes are situated in the plane of symmetry.

Hence it appears to be a fact that the absorption of luminous radiations of fixed wave-length admits of three directions of symmetry. These directions appear generally to coincide with the principal directions of optical elasticity, with the exception of certain remarkable anomalies in particular crystals. Here, however, is the whole gist of the matter. Why these anomalies? Just as from a consideration of the deviations from Boyle's law physicists have learned how to measure the size of those wonderfully minute entities familiar to us as molecules, so has M. Becquerel extracted a most important principle out of the anomalies to the law of absorption in crystals.

It appears probable that absorption may be due to a physical phenomenon dependent upon the intermolecular movements. The intimate relation between phosphorescence and absorption, notably in the compounds of uranium and certain of the rare earths, appears to show that in solids and liquids the radiations absorbed are those which vibrate in unison with the molecular movements. This conception is in fact nothing more than an extension to solids and liquids of the well-verified law of the absorption by incandescent vapours.

As the molecular elasticity varies in different directions in crystals not isotropic—that is, not belonging to the cubic system—so will the absorption vary ; and if, in two isomorphous substances, the directions of molecular elasticity do not exactly correspond, the directions of different absorption in the two substances will vary in like manner. Now it is quite true that many crystals of isomorphous substances—that is to say, substances of analogous chemical constitution crystallizing in similar forms—have their optic axes unequally inclined.

If we crystallize two such substances together, in gradually increasing proportions of one of them, we find that the angle between the optic axes in the mixed crystals diminishes progressively until it reaches zero, after which the two axes again diverge in a plane perpendicular to their original plane. Thus can we cause the influence of each in turn to preponderate.

Each chemical substance therefore exerts its own influence, and the molecules retain the optical properties which they manifest when the substance crystallizes alone. Hence the propagation of luminous waves is the resultant of the actions which each of the molecules composing the crystal exerts upon the luminous vibrations. If the directions of absorption do not coincide with the axes of optical elasticity, it indicates the presence of molecules of different substances in the crystal. From these considerations it will be evident that the anomalies are probably due to the coexistence in the same crystal of different matters, geometrically isomorphous, but optically unlike, and which from the absorption point of view behave as if each were alone. The use of the spectroscope will therefore enable us to recognize the individuality of differently

absorbing molecules in the molecular groupings, which other optical methods cannot indicate; for the absorption due to one molecule is independent of that of a neighbouring molecule, while the phenomena of refraction only show resultant effects.

Further, as experiment shows that in most crystalline substances the principal directions of absorption coincide with the principal directions of optical elasticity, and as it is probably right to assume that each molecule is subject to the same laws as the whole of the crystal, there is no reason to suppose that the directions of symmetry should be different in the molecule and in the crystal, provided the latter presents no optical anomaly. One can therefore assume that the principal directions of absorption in the molecules themselves coincide with their axes of optical elasticity, and that in mixed crystals the anomalous directions of absorption indicate the direction of the optic axes of the different absorbing substances. If this is really the cause of the anomalies in the direction of certain bands, each group of anomalous bands ought to belong to different substances, of which the existence in the crystal is thus revealed.

To prove the truth of this beautiful theory, M. Becquerel points out the significant fact that among the substances which he finds to be characterized by anomalous bands, several have been separated chemically into their components.

We have, therefore, in the observation of anomalous directions of absorption a new method of spectral analysis, a method of determining in a crystal the presence of isomorphous substances, optically dissimilar. We can even go further still, and recognize the existence of different substances, although they may not manifest anomalous directions of absorption. For, suppose the same bands are noticed to occur in the spectra of several crystals; if in one of these crystals two bands become maxima or minima at the same time for the same direction of vibration, and if in another crystal one of them disappears for the direction which renders the other a maximum, one may conclude that the bands are due to two different molecules.

This new method of analysis appears to be specially suitable for use in unravelling the mystery of the constitution of the rare earths. If, as seems now almost certain, they consist of the oxides of a large number of elementary substances, the difficulty experienced in separating them points to the fact that these constituent oxides must resemble each other closely. It is therefore most probable that their salts will be isomorphous, and the crystals of these salts may consequently be expected to give absorption spectra of great interest in the light of the foregoing theory. M. Becquerel has therefore subjected the crystalline salts of didymium to the test of experiment, with the important result that several substances have been detected which chemists have recently isolated chemically; and also new substances have been identified as constituents, of which chemical methods have not as yet revealed the presence.

It will be remembered that Auer von Welsbach, by fractional crystallization of the double nitrates of didymium and ammonium, obtained two solutions—one possessing a green colour, showing almost exclusively the three bands $\lambda = 482$, 469, and 445, and which he termed praseodymium; the other a red solution, giving the other bands of the didymium mixture except $\lambda = 475{\cdot}5$, which received the name neodymium. The study of the absorption spectrum of crystals of sulphate of didymium now shows that the two groups $\lambda = 483{\cdot}6$–$482{\cdot}2$ and $\lambda = 471{\cdot}5$–470, which have anomalous directions to a remarkable extent, are characteristic of praseodymium, while most of the bands of neodymium have directions quite different. Again, on examining these same groups belonging to praseodymium in the crystals of double nitrate of didymium and potassium, it is noticed that the bands which appear to have the same principal directions in the sulphate have in the double nitrate directions quite different, characterizing two distinct substances. Later experiments by Demarçay have indeed shown the possibility of chemically isolating two constituents—one exhibiting the band $\lambda = 469$, the other giving the bands of praseodymium.

Hence the new method proves a most valuable test of the accuracy of chemical work. In multiplying the observations, M. Becquerel concludes that didymium is, as expected, a mixture of a large number of substances, chemically different; among the identified constituents are almost all that have been already chemically isolated, and very probably others, notably one substance which is characterized by the band $\lambda = 571{\cdot}7$.

A remarkable confirmation of this new law of crystal absorption was obtained in the following way. When a crystal of the sulphate or nitrate of didymium is dissolved in water, the spectrum of absorption of the solution presents curious differences from that of the crystal. Certain bands have remained permanent, but others are displaced, and some have entirely disappeared. This is readily explained if one admits that the crystal consisted of a mixture of compounds unequally acted upon by water. The most interesting fact, however, is that the bands which manifest these variations are precisely those which in the crystal present the anomalies.

In conclusion, we see that by the employment of this new method of analysis we are enabled, without destroying the crystal, as is necessary in chemical analysis, to recognize the presence of different chemical molecules; and as we obtain three distinct spectra from the three directions of optical elasticity, the method is one of extreme sensibility. Every investigator likes to see his work confirmed, and in this most difficult field of the rare earths we cannot have too many confirmations. The more points of the compass from which we approach it the better, for we are sure then of surrounding and finally of grasping the truth itself, in all its grand simplicity.

A. E. Tutton.

THE NEW VEGETATION OF KRAKATAÕ.

THE great volcanic eruption of Krakataõ in August 1883 will be fresh in most memories. It was at one time reported that the island had totally disappeared, but this was not so. Previous to the eruption, however, it was covered with a luxuriant vegetation, no trace of which existed after the event.

Dr. M. Treub, the Director of the Botanic Garden at Buitenzorg, Java, when at Kew last year informed the writer that he had visited the island the previous year, and intended publishing the results of his botanical investigations. This he has now done,[1] and as the derivation of insular floras is a subject of great interest to many persons, the substance of Dr. Treub's communication deserves a place in Nature.

The existing portion of Krakataõ Island is about three miles across, and has the form of a mountain rising out of the sea. On one side it is nearly perpendicular almost to the summit of the peak, which has an altitude of about 2500 feet, and on the other it presents a steep slope. It is situated ten miles distant from the Island of Sibesie, the nearest point where there is terrestrial vegetation; twenty miles from Sumatra, and twenty-one miles from Java. Verlaten and Lang Islands, lying much nearer Krakataõ, were utterly desolated and denuded of their vegetation by the great catastrophe, and were still absolutely bare in 1886.

With regard to the total destruction of vegetable life in the island, Dr. Treub asserts that there can be no doubt:

[1] *Annales du Jardin Botanique de Buitenzorg*, vii. pp. 213–23, with a sketch map.

the most durable seed and the best protected rhizome must have lost all vitality during the intense heat, and not a germ was left. The whole island from the summit of the peak down to the water's edge is now covered with a layer of cinders and pumice stone, varying from one to sixty metres in thickness. Furthermore, the possibility of the new vegetation having been conveyed thither by man is out of the question, because the island is uninhabited, uninhabitable, and difficult of access.

Therefore, the present vegetation must be due to other agencies, of which three different ones may have operated —namely, winds, waves, and birds.

Now, as to the composition of the vegetation met with on Krakatão by Dr. Treub in June 1886, nearly three years after the eruption, the bulk consisted of ferns with isolated plants of Phanerogams, both on the shore and on the mountain itself. Eleven species of ferns were collected, and some of them were already common. They are all species of wide distribution, and it may be of interest to give their names: *Gymnogramme calomelanos, Acrostichum scandens, Blechnum orientale, Acrostichum aureum, Pteris longifolia, Nephrolepis exaltata, Nephrodium calcaratum, N.. flaccidum, Pteris aquilina, P. marginata, and Onychium auratum.*

It is not at all surprising that the spores of the foregoing and many other ferns should have been carried to the island by winds; but, as Dr. Treub remarks, it is almost incomprehensible that they should grow under such extraordinarily disadvantageous conditions. Chemically and physically the volcanic matter covering the island is as sterile as could well be, yet the prothallia of ferns readily developed. A closer investigation, however, revealed the fact that ferns were not the first organisms in the new vegetation of Krakatão, the cinders and pumice-stone being almost everywhere covered with a thin coating of *Cyanophyceæ* (fresh-water Algæ) belonging to the genera *Lyngbya, Tolypothrix*, &c.,—altogether six species. The presence of these Algæ gives the surface of the soil a gelatinous and hygroscopic property, in the absence of which Dr. Treub doubts the possibility of fern-growth. Thus these microscopic organisms prepare the soil for the ferns, much as the latter provide the conditions under which the seeds of Phanerogams can germinate and grow.

The phanerogamic element (flowering plants) of the new vegetation consisted, on the shore, of young plants of *Calophyllum Inophyllum, Cerbera Odollam, Hernandia sonora, Scævola Kœnigii, Ipomœa pes-caprœ*, a species of *Erythrina*, two species of *Cyperaceæ*, and *Gymnothrix elegans*. With the exception of *Gymnothrix elegans*, a common grass in Java, all the plants named are among those which take possession of newly-raised coral islands.

In the interior of the island, on the mountain itself, Dr. Treub discovered *Scævola Kœnigii, Tournefortia argentea*, a species of *Wollastonia*, a species of *Senecio*, two species of *Conyza, Phragmites Roxburghii*, and *Gymnothrix elegans*.

In addition to the foregoing Phanerogams, Dr. Treub observed on the sea-coast seeds or fruits of *Heritiera littoralis, Terminalia Catappa, Cocos nucifera, Barringtonia speciosa*, and *Pandanus*. These also are among the commonest sea-shore and coral island trees throughout the Malayan Archipelago and Polynesia.

A more interesting record of the processes of a new flora can hardly be imagined, especially that in relation to the preparation of the soil by microscopic sporiferous plants. Of course this is not a new discovery; but it is perhaps the first actual observation of the renewal of the vegetation of a volcanic island.

Dr. Treub intends visiting Krakatão again, and reporting fully on the progress of the new flora, and his report will doubtless be looked forward to with great interest.

W. B. HEMSLEY.

THE NON-CHINESE RACES OF CHINA.

A VALUABLE Report which has just been laid before Parliament contains an account of a journey made by Mr. Bourne, British Consular Agent at Chung-King in Szechuen province, through South-Western and Southern China, to study certain commercial questions in these regions. The journey lasted 193 days, and carried the traveller through the great provinces of Yunnan, Kwangsi, Kweichow, and Szechuen. Mr. Bourne was constantly brought into contact with various non-Chinese tribes inhabiting these provinces, and his Report contains a large amount of information respecting their language and habits. He also devotes a special appendix to them. He says that there is probably no family of the human race, certainly none with such claims to consideration, of which so little is accurately known as the non-Chinese races of Southern China, and he attributes this to the "perfect maze of senseless names" in which the subject has been involved by the Chinese. The "Topography of the Yunnan Province," published in 1836, gives a catalogue of 141 classes of aborigines, each with a separate name and illustration, without any attempt to arrive at a broader classification. To Mr. Bourne it appeared that before the tribes could be scientifically assigned by ethnologists, they must be reduced to order amongst themselves, and that something might be done in this direction by taking a short vocabulary and obtaining its equivalent in the dialect of every tribe met with, when a comparison would reveal affinities and differences. Accordingly he gives twenty-two vocabularies, containing the numerals up to 12, 20, 30, 100, 1000, father, mother, brother, sister, heaven, gold, hand, foot, sun, dog, horse, iron, &c.—in all, thirty-six words. In each case the date, place, the name by which each tribe calls itself, the name by which the Chinese know it, and the name by which it knows the Chinese, is given. A comparison of these vocabularies and a study of Chinese books lead him to the conviction that, exclusive of the Tibetans, there are but three great non-Chinese races in Southern China—the Lolo, the Shan, and the Miao-tsze. The vocabularies do not convey the whole evidence that these scattered people respectively speak the same language, for the Lolo, Shan, and Miao-tsze are all languages of the Chinese type that make up for poverty of sound by "tones"; the resemblance is much more striking to the ear accustomed to these distinctions of sound than when the words are written in English, when the similarity of tone is lost. Among the 141 tribes described in the Chinese topography of Yunnan, with short vocabularies of the principal dialects, there are very few, and those unimportant, that cannot be identified from the illustrations or letterpress as belonging to one or other of the three families or to Tibetan. As to the names of these families, Lolo is a Chinese corruption of Lulu, the name of a former chieftain of the people, who call themselves Nersu, and has come to stand for the people themselves. Shan is the Burmese term adopted by Europeans for the people who call themselves "Tai," "Pu-nong," &c. Miao-tsze, a Chinese word, meaning "roots," is confined by the more accurate to the aborigines of Kweichow and Western Hunan.

The Lolos were formerly called by the Chinese the "Tsuan barbarians," a name taken from one of their chiefs. They call themselves Nersu, and the vocabularies show that they stretch in scattered communities as far as Ssu-mao, and along the whole southern border of Yunnan. They are also said by the Chinese to be found on the Burmese frontier. In a topography of Momien, a town not far from Bahmo, in the extreme south-west of Yunnan, the following information is given about them, which is at least surprising:—"The old Tsuan (Lolo) of Mengshan do not die. When old, they grow tails, eat men, not distinguishing their own children,

love the hills, fear the abodes of men, and run as strongly as wild beasts. The natives call them autumn foxes. But, still, they are not invariably to be found." Although it is not yet known where the Lolo came from, Mr. Bourne gives a notion of their present habitat. In the great bend of the Yangtsze, in 103° E. longitude, between that river and the Anning, the Lolo are at home; there they live in independence of China, under their own tribal chiefs and aristocracy. Thence they extend in a scattered manner as far north as Wen-chuan, in latitude 31° 15′ N., and longitude 103° 30′ E. To the west they extend to the Meikong; to the south they are found occupying here and there the higher ground, until the plateau breaks into the plain, and they extend eastward to Kweiyang. They seem to be more numerous as Taliang Shan, their present home, is approached, and they form much the largest part of the population of North-Eastern Yunnan and North-Western Kweichow. Mr. Bourne adds about thirty names by which different tribes of Lolo are known to the Chinese.

The Shans are not found north-east of the city of Yunnan, but they inhabit all the lower levels along the south Yunnan border; and from the city of Kwang-nan along Mr. Bourne's route to the frontier of Kweichow province, they form almost the whole population. They must have been masters of the Kwangsi province before the Chinese, as some of the Chinese official buildings in the province are said to have been erected on the sites of Shan palaces. It would be interesting, says Mr. Bourne, to know how the Shans reached Kwangsi, whether through Tonquin or across the Yunnan plateau. The Shans in Southern Kweichow are undoubtedly immigrants from Kwangsi, and did not cross the plateau. The Shan language is softer than Chinese or Lolo, with fewer gutturals and aspirates, and appears easy to learn. The numerals show a curious resemblance in sound to the Cantonese.

The Miao-tzse apparently are divided into a number of tribes speaking dialects of one language which is of the Chinese sort. They occupy at present Eastern Kweichow and Western Hunan, being very numerous in the south-east of the former province. They are known to the Chinese by a multitude of names, but always with the prefix Miao.

So far the appendix; but scattered throughout Mr. Bourne's elaborate report of his journey there are numerous interesting references to these non-Chinese races. Near Maling, in Southern Yunnan, on a tributary of the Yangtsze, he came on a sandstone bluff containing about twenty Mantzu caves. Most of the entrances, 3 to 4 feet square, are cut in the vertical cliff some 10 feet above the ground, so that they cannot be reached without a ladder. The face of the cliff is adorned in one or two cases by sculptures in relief, the most striking being a round human face. The valley was, no doubt, formerly the head-quarters of a Mantzu tribe, for some miles lower down the site of the castle of a chief is pointed out. The sculptured blocks that lie about bear witness to a considerable advance in civilization. The Lolos are described as having larger and more irregular features than the average Chinese; the colour of the skin seems much the same, but the eyes were deeper sunk. They are divided into three tribes, known as the black, white, and dry Lolos—a meaningless distinction, but corresponding apparently to a real tribal division. They believe in a future state of retribution, burn the dead, worship their ancestors with the sacrifice of an ox, and have no idols. Four pieces of brown paper were said to represent the potentialities of the other world, and three sticks of bamboo their ancestors. A special Lolo vocabulary, with the written characters, procured from a *perma*, or tribal sorcerer, in Ssu-mao, is carefully reproduced. This sorcerer was able to read his prayer-book, but not to explain what it meant. In his own opinion this was not important, as the ritual had been arranged between his ancestors and the gods, who knew very well what was meant so long as he read the right section and gave the characters their proper sound.

The Report it should be added contains numerous and comprehensive tables of meteorological observations and levels, although the rate of travelling prevented anything like a running survey being made.

THE BATH MEETING OF THE BRITISH ASSOCIATION.

THIS will be the fifty-eighth meeting of the British Association for the Advancement of Science. Twenty-four years ago—in 1864—the Association met at Bath under the presidency of the late Sir Charles Lyell. So many other names are now missing, that the retrospect is the reverse of cheering. Sir Roderick Murchison, Admiral Fitzroy, Dr. Whewell, Sir John F. W. Herschel, Sir David Brewster, Dr. William Farr, Prof. Fawcett, Dr. Livingstone, Capt. Maury, and Mr. Scott Russell, are only a very few of the numerous names of note that spring to the memory in connection with the last Bath meeting.

But if this is the retrospect, the prospect is in every way most satisfactory. Under the genial presidency of Sir Frederick Bramwell, with the aid of very efficient local officers, a thoroughly successful meeting may fairly be looked for. Bath has the advantage of a good position for railway facilities. It is not more than 2½ hours from London, 2 from Exeter, 1½ from Cardiff, 1½ from Birmingham, and 5½ from Manchester. The endeavours of the Local Executive Committee to obtain the issue of cheap tickets, as usual, have been crowned with success. As Bath—strangely enough—does not possess a Public Hall, a temporary building, to serve as reception-room and offices, is in course of erection, at a cost of some £700. The President's address, the evening discourses, and Sir John Lubbock's lecture to working men will be given in the Drill Hall.

It is unnecessary to say anything as to the fitness of Sir Frederick Bramwell for the office of President. The following are the Presidents of the Sections:—Mathematics and Physics, Prof. Schuster; Chemistry, Prof. Tilden; Geology, Prof. Boyd Dawkins; Biology, Mr. Thiselton Dyer; Geography, Sir Charles Wilson; Statistics, Lord Bramwell; Mechanics, Mr. Preece; Anthropology, General Pitt-Rivers.

Bath itself is so well known as to need very few words. The old Roman Bath and its adjuncts, recently uncovered, with other remains, will of course excite general interest. Attention will also be given to the new buildings erected by the Corporation to meet the increasing demand for the Bath waters. On every side the city is surrounded by objects that will interest the geologist, the archæologist, and the lover of the picturesque. Provisional arrangements have been made for a set of excursions—half-day, on Thursday, September 6, and whole day on Saturday, September 8—to Stantonbury, Stanton Drew, Maes Knoll; Dyrham, Sodbury Camp, Bannerdown; Stourton, Pen Pits, Whitesheet, Longleat; Frome, Wells, Glastonbury, Cheddar, Chepstow, Tintern, Box Quarries, Cirencester, Severn Tunnel, Tytherington, Thornbury, Berkeley, Ebbor Gorge, Wookey, and elsewhere.

PROF. H. CARVILL LEWIS.

THE loss to the geological world by the death of Prof. Henry Carvill Lewis at the early age of thirty-four, and in the midst of his work, is greater than they may realize, as the more important of his results acquired during the last three years have not been fully published. When, in 1882, he began to study the glacial phenomena of

Pennsylvania, though numerous observations had been made on the direction of the striæ and the location of the moraines, in the northern part of the States, nothing had been attempted towards gathering the results into a consistent whole, or tracing the limits of the glaciation. In that year he succeeded in tracing a great terminal moraine from New Jersey to the Ohio frontier, and showing that beyond this line glaciation was absent, while within it the direction of the motion could be traced as well by the striæ as by the derivation of the boulders. Of the truth of these views he succeed in convincing almost all the American geologists who had studied the question. Fired by his success in interpreting the glacial phenomena of his native country, and believing that the same key might be found to unlock the mysteries of European glaciation, he practically threw up his position in Philadelphia, and devoted himself to the study of these phenomena in Great Britain. Devoting his summers from 1885 to the work, he visited—accompanied by his wife, whose active assistance he constantly enjoyed—almost every locality in Great Britain and Ireland where striæ had been recorded or moraines were likely to occur. To reduce the whole of the previous observations to order was a task he had not yet succeeded in completing, but which he boldly undertook, and to continue which he had once more landed in England. Important results were, however, already obtained, and at the British Association last year he gave English geologists the firstfruits, by presenting them with a map of England in which he had traced a great terminal moraine, as in America, on the north of which the striæ and the dispersion of the boulders indicated a continuous ice-sheet, while to the south the various glacial deposits were accounted for by extra-morainic lakes. He boldly advocated the view of the ice mounting up to the heights of 1100 feet in Moel Tryfaen and elsewhere, where the ice-sheet had crossed the sea, declaring that anyone who was acquainted, as he was, with the far greater results of ice-motion in Pennsylvania would have no difficulty in accepting this, and pointing out that these localities were everywhere on the line of the great terminal moraine. So startling a generalization could scarcely be accepted all at once, and there were many things to account for before the history even of this greatest ice-sheet could be considered complete. Had Prof. Lewis been spared to us, he was prepared to devote himself to the completion of this work. He has left a large mass of notes and drawings bearing on it, which must now wait for some Elisha capable of taking up his mantle. Every glacialist is no doubt more or less satisfied with the account he can give of the glacial history of his own district; but to the general geologist the whole has hitherto presented a chaos of conflicting histories, fit only to bewilder him. In the clear account given by Prof. Carvill Lewis of one great portion of that history, light seemed at last to dawn, and the hope was raised that glacial chaos would cease. This hope now seems quenched for a time.

Prof. Lewis was born in Philadelphia, November 16, 1853, and took his B.A. degree in 1873 in the University of Pennsylvania. From 1879 to 1884 he was a volunteer member of the Geological Survey of the State. In 1880 he was elected Professor of Mineralogy in the Academy of Natural Sciences, Philadelphia, and in 1883 Professor of Geology in Haverford College. His work was by no means confined to his glacial studies, the most important of his minor works being the discovery of the matrix of the diamond in an ultra-basic volcanic rock in contact with a carbonaceous tuff. The prediction that, if such was the origin of diamonds, they might be found in meteorites, had just been fulfilled in Russia; and he had lately visited a locality in Carolina, where the same conditions obtain, but had not proceeded further when he was stopped by death. During the last three years he spent his winters in Heidelberg, studying microscopic petrography with Prof. Rosenbusch.

Those who knew him personally, were charmed with the beautiful frankness of his nature, his love of truth, his invariable possession of a reason for what he said, and his total lack of pride or assumption of authority. They saw in him a type of what a genuine student of Nature should be, tempered and refined by general culture. Few who knew him at all but must feel they have lost a friend, and an example.

He married in 1882, and leaves a wife and one daughter.

*SONNET**

TO A HIGH SOPRANO

Accompanying herself on the Piano.

THE larks who sing at Heaven's high gate despair
To match thy notes so piercing-sweet and true
That, pure as in night's hour fresh-fallen dew,
Vouch thou art good, e'en as thou art most fair.
Why seek with gems to deck thy radiant hair,
Thy flashing, rushing, fingers to indue
With rubies' blaze or Opal's orient hue—
Thou canst in nobler wise thy worth declare.
Oft shall the rapt enthusiast in his cell
Intent on Nature's all-pervading clue
Pause, to bid Memory with her magic spell
Restore that heavenly, loved, lithe form to view
And in fond fancy hear thy voice anew
Till life to gladness breathes its last farewell.

New College, Oxford, July 20. J. J. S.

NOTES.

THE annual meeting of the British Medical Association was opened at Glasgow on Tuesday, the 7th inst. Prof. Gairdner, the President, delivered an address on "The Physician as Naturalist." Speaking of the methods of education necessary for the training of a physician, Prof. Gairdner urged that medical students do not at present receive adequate instruction in physics. "When we consider," he said, "how completely modern science has demonstrated the subordination of living bodies and physiological processes, not to a wholly detached set of laws termed vital, but to all the most elementary laws of matter; and, further, the correlation of all the physical forces throughout the universe, so that the living body and its environment act and react on each other throughout infinite space and time, it will be readily admitted, I think, that some kind of systematized instruction in physics, and not a mere elementary examination in mechanics, should be an essential part of an education with a view to the medical profession. And when we further consider that most of the great advances in medical diagnosis in the present day, through the stethoscope, microscope, laryngoscope, ophthalmoscope, sphygmograph, electricity as applied to muscle and nerve, &c., involve applications of pure physics which are neither remote from practice nor yet very easily mastered by the beginner; and that, in the case of electricity and other physical reagents, even heat and cold, &c., we are every day extending the domain of these sciences in therapeutics, and still more perhaps in preventive medicine and sanitary science, their claim for an extended recognition in teaching seems to be enormously enhanced. I am persuaded that in a very few years the physical laboratory will become an absolutely essential preliminary step in the education of the physician of the future, and that those who have not undergone this training will be hopelessly distanced in the race."

* In the next number of NATURE will appear the Original of this sonnet addressed

To a Young Lady with a Contralto Voice.

THE Organizing Committees of Sections A and G of the British Association have arranged a joint discussion on lightning conductors, to be held at the Bath meeting in September. Mr. W. H. Preece, F.R.S., will open the discussion, and Prof. Oliver J. Lodge, F.R.S., willl defend the position he laid down this year before the Society of Arts.

AGREEABLY to a resolution of the International Congress of Hydrology and Climatology held at Biarritz, in October 1886, the second triennial session of the Congress will be held in Paris next year, at the beginning of October, in connection with the Exhibition there. The President of the Committee is M. E. Renou, Vice-President of the French Meteorological Society. A preliminary programme has been issued, setting forth the questions to be discussed under (1) scientific hydrology; (2) medical hydrology; and (3) climatology. The subscription of membership is 12 francs.

THE new Marine Biological Laboratory at Wood's Holl, Massachusetts, was formally opened on the day appointed, Tuesday, July 17. Several members of the Board of Trustees, a few students, and a half-dozen or more of guests were present, and spent the morning in examining the new building and its equipment, and in visiting the laboratories and aquaria of the United States Fish Commission. At two o'clock the whole party dined at Gardiner Cottage—the domestic head-quarters of the new enterprise—which a generous citizen of Wood's Holl, Mr. J. S. Fay, has kindly put at the disposal of the trustees. Shortly after three o'clock the Director, Dr. C. O. Whitman, delivered in the Laboratory an opening address upon the history and functions of marine biological laboratories, referring especially to the Penikese School and to Prof. Baird's labours in this direction. Prof. C. S. Minot then said a few words on behalf of the trustees. Some eight or ten students are already at work in the Laboratory; and *Science* says that the responses from colleges and from students make it certain that next year there will be at the institution a large and enthusiastic gathering of investigators and students in biology. The building, according to *Science*, appears to be admirably adapted to its purposes. It is plainly but strongly built, of wood, two stories high, and with a pitched roof. The roof and sides are covered with shingles, unpainted. There is a commodious and convenient basement under the western half of the building, intended for storage, for the safe keeping of alcohol, boats, oars, and the like. The lower floor of the Laboratory is intended for beginners, and for teachers and students who are learners but not investigators. The upper story is for investigators only. The equipment includes work-tables, specially designed, and placed before the large and numerous windows. Each student is provided with a Leitz microscope, a set of reagents, watch-glasses, dissecting pans, and the dishes and other things indispensable to good work. The Laboratory owns boats, dredges, nets, and other tools for collecting. A small library has been provided, and, under the progressive and efficient management of Dr. C. O. Whitman and Mr. B. H. Van Vleck, a season that promises to be highly successful, and most important in the history of American biology, has been auspiciously begun.

MR. HENRY O. FORBES, the New Guinea explorer, author of "The Naturalist in the Malay Archipelago," has been selected by the London Commission to succeed the late Sir Julius von Haast as Director of the Canterbury Museum, New Zealand.

SOME time ago a good deal of interest was aroused by a controversy as to the effects of light on water-colours. The Committee of Council appointed a Committee of artists to consider the subject; and Dr. W. J. Russell and Captain Abney were invited to investigate the scientific aspects of the question. A Blue-book has just been issued, containing the first report of these two gentlemen.

WE regret to record the death of Miss Glanville, who was well known in South Africa as the Curator of the Albany Museum, Grahamstown, Cape of Good Hope. This clever and accomplished young lady discharged her duties as Curator most conscientiously and ably, and did much to promote an interest in science in her native town and country.

A NEW gas, possessing some remarkable properties, has been discovered by Prof. Thorpe and Mr. J. W. Rodger, in the research laboratory of the Normal School of Science. It is a sulpho-fluoride of phosphorus of the composition PSF_3, and is termed by its discoverers thiophosphoryl fluoride. The best method for its preparation consists in heating pentasulphide of phosphorus with lead fluoride in a leaden tube. It may also be obtained by substituting bismuth fluoride for the fluoride of lead, the only difference between the two reactions being that the second requires a higher temperature than the first. Again, when sulphur, phosphorus, and lead fluoride are gently warmed together, an extremely violent reaction occurs, but if a large excess of the fluoride of lead be employed a tolerably steady evolution of the new gas occurs, the excess of the lead salt appearing to act as moderator. It is an interesting fact, throwing considerable light upon the constitution of the sulpho-fluoride, that it may be obtained by heating together to 150° C. in a sealed tube a mixture of the corresponding chloride—thiophosphoryl chloride, $PSCl_3$, a mobile colourless liquid—and trifluoride of arsenic. The simple exchange of chlorine for fluorine here brings about a striking physical change, from a highly refracting liquid to a colourless gas. And now for the remarkable properties of the gas. In the first place, it is spontaneously inflammable. If it be collected over mercury, upon which it exerts no action, in a tube terminating above in a jet and stopcock, and the latter be slowly turned so as to permit of its gradual escape, the gas immediately ignites as it comes in contact with the air, burning with a greenish-yellow flame tipped at the apex with blue. If, however, a wide tube containing the gas standing over mercury be suddenly withdrawn from the mercury trough, the larger mass of gas ignites with production of a fine blue flash, the yellowish-green tint again being observed as the light dies away. Thiophosphoryl fluoride is readily decomposed by the electric spark with deposition of sulphur. If a quantity contained in a tube over mercury be heated for a considerable time, complete decomposition occurs, sulphur and phosphorus both being deposited upon the sides of the tube and gaseous silicon tetrafluoride left. From a spectroscopic examination, dissociation was shown to occur at the lowest temperature of the electric spark. The gas is slowly dissolved by water, and appears to be somewhat soluble in ether, but alcohol and benzene exert no solvent action upon it. Finally, the colourless, transparent gas was reduced to a liquid, somewhat resembling the sulpho-chloride, by means of Cailletet's liquefaction apparatus.

A VOLCANIC eruption, which began on August 3, in the Island of Vulcano, one of the Lipari Group, is said to have done an immense amount of injury. The greatest damage has been caused on the property of an English company under the management of Mr. Harleau, the estate being completely destroyed.

WE have received the Year-book of the Meteorological Observations of the Observatory of the *Madgeburg Journal* for the year 1886, being the fifth of the series. It contains observations taken three times daily, with means and monthly summaries according to the international scheme, hourly observations of the self-recording instruments, and fac-similes of the sunshine records; also additional observations, such as earth-temperature, evaporation, underground water, &c., as in previous years. The principal alteration is the omission of the continuous barograms: these are now given only in cases of special interest, owing to the expense of the reproduction. We have already

expressed our approval of this method of dealing with continuous records, as opposed to the costly reproduction of the curves in their entirety.

THE "Annuaire" of the Municipal Observatory of Montsouris for the year 1888, just published, a volume of 612 pages, 18mo, contains a large amount of useful information, relating to the meteorology of Paris, and the microscopical examination of the organisms in the air and water. The report shows that the site of the Observatory is favourable for determining the climate of Paris with exactitude; some of the thermometric differences between Paris and Montsouris are very marked. The amount of rainfall also is somewhat greater at Montsouris, owing probably to better exposure than at Paris, but the differences are not greater than are frequently found with gauges placed near each other. The tables contain monthly means of temperature from the year 1806, and of rainfall since 1689; the values prior to 1873 are those referring to Paris. Self-registering thermometers were first used in 1835; up to this date the minimum temperatures were taken as the readings at sunrise, and the maximum readings, as those at 3 p.m. The yearly extremes of temperature date back to 1699.

WE learn from *Science* that the famous Bahia or Bendego meteorite, described by Morray and Wollaston in the Philosophical Transactions for 1816, and by Spix and Martius in their "Travels in Brazil," was landed in Rio de Janeiro on June 15, and is now in the collection of the Brazilian National Museum. The transportation of this great mass of iron, whose weight was variously estimated from six to nine tons, and which has been found to weigh 5361 kilogrammes, was rendered possible by the recent completion of a line of railroad passing within 115 kilometres of the Bendego Creek, where it has lain since the unsuccessful attempt to remove it to Bahia in 1785. Credit for the removal of the meteorite is due chiefly to Chevalier José Carlos de Carvalho, who gratuitously took charge of the technical part of the operation, and to Baron Guahy, who paid all the necessary expenses. The Brazilian Government also cordially associated itself with the undertaking. After about three months spent in preparing material and in studying the route to be traversed, the march began on November 25, 1887, and the meteorite was placed on the railroad on May 14 of the present year. A road had to be opened for this special purpose, as those existing in the region are only mule paths; and over one hundred streams, one with a width of 80 metres, had to be crossed by temporary bridges. The route lay over several chains of hills and one mountain range, in which an ascent of 265 metres had to be overcome with a grade of 32 per cent.

THE Canadian Institute, Toronto, has issued a "sociological circular," asking co-operation in the task of collecting trustworthy data concerning the political and social institutions, customs, ceremonies, &c., of the Indian people of the Dominion. Suitable papers upon the topics indicated will be published in the Institute's Proceedings. The Canadian Pacific Railway carries, free of charge, packages intended for the Institute's Museum, which is open daily.

THE Kew Bulletin for the months of November 1887 and January 1888 supplied valuable information, derived from official sources, respecting the capabilities of certain colonies for the production of fruits. The Bulletin for November 1887 was wholly devoted to a comprehensive report on the fruits of Canada. The Bulletin for January 1888 was devoted to reports furnished by their respective Governments on the fruits of Victoria, South Australia, Western Australia, Tasmania, New Zealand, Cape Colony, and Mauritius. In the Bulletin for August, just issued, the publication of such reports is continued. A summary of information is presented relating to the fruit productions and fruit resources of the West Indian colonies —Jamaica, Bahamas Islands, Barbados, St. Lucia, St. Vincent, Grenada, Tobago, Trinidad, and British Guiana.

THE Report of the Comptroller-General of Patents, Designs, and Trade Marks for the past year states that the total number of patents applied for was 18,051, being an increase of about 900 on the year before; of designs, 26,000 as against 24,000 of the preceding year; and of trade marks, 10,586, being a decrease of 91 from the preceding year.

THE American Statistical Association publishes some interesting figures on the amount of water-power employed in the United States. In 1880 there was a total water-power equal to 1,225,379 horse-power used for manufacturing-purposes, this being 35·9 per cent. of the total power thus employed in the States. The annual value of the water-power thus utilized is set down at 24,000,000 dollars. The New England States alone use 34·5 per cent. of the whole water-power of the country, and altogether the Atlantic States use over three-fourths of the whole.

ACCORDING to a return of the Board of Trade on sea-fisheries in the United Kingdom, the total amount of fish landed on the English and Welsh coasts, exclusive of shell-fish was, in 1887, about 301,000 tons, of the value of about £3,780,000. Shell-fish taken in that year were of the value of £324,000. For the year 1886 the figures were—fish landed, 320,000 tons, of the value of £3,688,000, and shell-fish of the value of £269,000. Thus, while there was a decrease in weight of about 19,000 tons, there was an increase in value of about £90,000, and in the shell-fish an increase of £55,000.

IN a Report of M. Renduel to the French Minister of Marine, he attributes the gradual decline of the sprat-fisheries of France to the methods hitherto pursued in fishing. The sprat seine-net, he says, is most destructive. When thrown out fully, as is usually the case, and then towed towards the shore, it drags the bottom over an enormous area, and brings to land not only the sprats, but shoals of other fish not yet fully developed, and quite unsalable. The French newspapers say, with a little pardonable exaggeration perhaps, that thousands of cubic metres of winter fry, which would give in summer millions of cubic metres of edible fish, have been used as manure in the fields, in order to force grass and cereals. So far has this been carried, that the non-migratory fish are almost exterminated in many places.

IN the Report of the British Consul at Tunis to the Foreign Office, he says that the sponge fishery is a very important branch of industry in that country. There are in all about 400 Greeks, 500 Sicilians, and 1400 natives engaged in the pursuit. The diving apparatus was formerly in use, but it has given way to a kind of dredging instrument similar to that used in the oyster fishery. The same Report says that the tunny fishery is a monopoly of the State. The fish enter the Mediterranean in the spring, and one body of them strikes the coast at Cape Bon. Here the net-fishing begins. The boats gather around the nets, and the fish are harpooned and dragged into the boats, as many as 600 being thus frequently taken in one haul. They are then cut up and preserved in olive-oil, packed in tins of various sizes, and soldered up. About three-fourths of the fish are thus treated, and sent away to Italy, where they meet a ready sale. The rest are either eaten fresh, or salted and sent away to Malta or Sicily. Between 200 and 300 men are engaged in this work, which is of the annual value of £20,000.

A VERY rare fish, *Plagyodus* (*Alepisaurus*) *ferox*, has just been caught in the Karlsöfjord, in Iceland. It is 5 feet 9 inches long, with small shark-like fins, those on the back being about a foot in length. The head is pointed, and the teeth long and sharp. It appeared to lie asleep on the surface of the water, and a fisher-

man caught it by its tail, when it attempted to bite him. Prof. Lütken states that hitherto only three specimens of this fish have been caught, viz. one at Madeira, one in Greenland, and one previously in Iceland. It is believed that this is the mysterious fish the *fax-ál*, *i.e.* the eel with a mane, of which the Faroe fishermen stand in such awe.

THE Assistant Superintendent of the Forest Department of Penang has tried the raising of mahogany-trees from seeds, but with what success is not yet known. He also tells us that a trial venture in cultivating patchouli has proved very successful. Experiments in growing olives, oranges, citrons, &c., have proved encouraging, and trials with European vegetables show that tomatoes, carrots, lettuce, onions, celery, &c., can be successfully cultivated in the Straits Settlements.

IN "The Fodder Grasses of Northern India," just published at Roorkee, Mr. J. F. Duthie gives an instructive account of the more important kinds of grasses that are used in the plains of Northern India either for fodder or for forage. Several of the plains species extend up to considerable elevations on the Himalaya, but Mr. Duthie has omitted all mention of those which are exclusively Himalayan. The area of country to which the work refers, and which coincides with that over which his botanical researches generally will in future be conducted, extends from the north-west frontier, and includes the Punjab, the North-West Provinces, and Oudh, Sindh, Rájputána, Central India, and the Central Provinces.

A NEW edition of the Catalogue of Lewis's Medical and Scientific Library has just been issued. It includes a classified list of subjects, with the names of those authors who have dealt with them.

THE first University of Siberia has just been opened at Tomsk. It has for the present only one Faculty, that of Medicine. How urgently necessary the establishment of this Siberian Faculty of Medicine has become may be seen from some figures sent to the *Times* the other day by its St. Petersburg Correspondent. The practice of one doctor is supposed to extend over each of the following districts, with their respective populations :—Tobolsk, 129,785 square versts, 110,323 inhabitants; Akmolinsk, 87,833 square versts, 80,062 inhabitants; Semipalatinsk, 85,705 square versts, 100,225 inhabitants. In short, there are only twenty-two doctors over an enormous territory of 2,815,547 square versts.

IN the article "Lord Armstrong on Technical Education," in our last issue, an unfortunate slip occurs at p. 314, in the second column, which destroys the force of the argument: £74,000, not £24,000, should have been stated as the sum which it was proposed to spend on the erection of a new chemical department of the Zurich Polytechnicum.

THE additions to the Zoological Society's Gardens during the past week include a Purple-faced Monkey (*Semnopithecus leucoprymnus* ♂) from Ceylon, presented by Mr. Martin J. Cole; a Rhesus Monkey (*Macacus rhesus* ♂) from India, presented by Mr. Reginald S. Knott; three Black-eared Marmosets (*Hapale penicillata*) from South-East Brazil, presented by by Mr. J. A. Deintje; a Chipping Squirrel (*Tamias striatus*) from North America, presented by Mrs. Matveiff; a Common Squirrel (*Sciurus vulgaris*) British, presented by Mr. R. Grant Watson; a Tayra (*Galictis barbara* ♂) from South America, presented by Mrs. J. H. Pollard; a Lesser Sulphur-crested Cockatoo (*Cacatua sulphurea*) from Moluccas, presented by Mr. J. Wolfe Barry; a White-backed Piping Crow (*Gymnorhina leuconota*) from Australia, presented by Miss Alice Rutherford; a Herring Gull (*Larus argentatus*), British, presented by Mrs. Huthwaite; an Ashy-headed Gull (*Larus cirrhocephalus*), a —— Bittern (*Butorides* ——) from South America, presented by Dr. A. Boon, C.M.Z.S.; a Common Kestrel (*Tinnunculus alaudarius*), British, presented by Mr. W. A. W. Jones; a Smooth Snake (*Coronella lævis*) from Hampshire, presented by Mr. E. G. Meade-Waldo; a Rhesus Monkey (*Macacus rhesus* ♂) from India, a Common Boa (*Boa constrictor*) from South America, an Æsculapian Snake (*Coluber æsculapii*) from Langenschwalbach, Germany, deposited.

OUR ASTRONOMICAL COLUMN.

ENCKE'S COMET.—Encke's comet was picked up at the Cape Observatory on August 3, its place at 6h. 10m. 56·6s. being recorded as R.A. 12h. 12m. 59s.; Decl. 17° 27′ 46″ S. This compares with Dr. Backlund's ephemeris (*Astr. Nach.*, No. 2843) as follows: O − C; R.A. + 4m. 43s.; S. Decl. + 34′ 52″. The ephemeris for the next few days runs as below :—

For Berlin Midnight.

1888.	R.A. h. m. s.	Decl. ° ′	Log *r*.	Log Δ.	Brightness.
Aug. 10	13 9 20	23 30·2 S.	0·0038	9·8790	0·69
12	13 25 34	24 56·1	0·0176	9·8896	0·62
14	13 41 21	26 11·4	0·0308	9·9014	0·55
16	13 56 36	27 17·2	0·0435	9·9142	0·49
18	14 11 21	28 13·7	0·0556	9·9275	0·44
20	14 25 28	29 1·7	0·0673	9·9415	0·39
22	14 38 59	29 41·9	0·0785	9·9559	0·35
24	14 51 52	30 15·4	0·0893	9·9708	0·31
26	15 4 10	30 42·7	0·0997	9·9857	0·27
28	15 15 54	31 5·3 S.	0·1097	0·0009	0·24

The brightness at discovery is taken as unity.

THE MASS OF TITAN.—The values which have been deduced for the mass of Titan by different astronomers showing a wide diversity, Mr. G. W. Hill has undertaken, in *Gould's Astronomical Journal*, No. 176, a new determination of this constant from the influence of Titan on the motion of Hyperion. Assuming Hyperion to be in opposition to Titan, at the same time that it is in perisaturnium, then, at the end of the half-synodic period—viz. 31·81828065d.—it would be in conjunction with Titan; and but for the action of Titan, ϕ, the angle the radius-vector makes with the direction of motion, would = 90° 8′ 51″·85. But the influence of Titan reduces this to a right angle, and this effect may be used to discover the mass of that body. Computing the motion of the line of apsides during the half-synodic period from opposition to conjunction, all powers but the first of the disturbing force being neglected, the value of Δw corresponding to the argument 31·81828d. was found to be − 2634″ instead of − 5898″, as given by observation. The mass, therefore, of Titan would require to be changed from 1/10,000, the value assumed at first, to 1/4466. The eccentricity of the orbit of Titan, 0·028, had been neglected, and that of Hyperion taken as 0·1. With this better value for Titan's mass, the path of Hyperion from opposition to conjunction is then traced by mechanical quadratures, no powers of the disturbing forces being neglected. The two unknowns to be determined were—the velocity with which Hyperion should start from opposition, and the mass of Titan; and the two determining conditions—that the conjunction should take place 31·81828d. after opposition, and that Hyperion must be then moving at right angles to its radius-vector. The resulting mass is found to be 1/4714, and the osculating elements of Hyperion at opposition—

$$\text{Daily } n = 60963''{\cdot}23942$$
$$\log a = 0{\cdot}0823532$$
$$e = 0{\cdot}0994706$$

Prof. Newcomb, in one of the "Papers for the Use of the American Ephemeris," vol. iii., part 3, has also described the perturbations of Hyperion arising from the action of Titan, and deduced the mass of Titan as 1/12,500, but Mr. Hill points out hat this value should have been divided by 3. M. Tisserand's value from a similar inquiry, 1/10,750 (*Comptes rendus*, tome ciii. No. 9), stands out in strong contrast with Prof. Hill's result; but Prof. Ormond Stone, on the other hand, who had obtained a larger result, has more lately, after correction of an error in his investigation, brought it down to a value closely according with that of Prof. Hill.

Assuming the diameter of Titan as 0".75—the value given independently by Schrœter, Mädler, and Struve—the density of the satellite would be about one-third that of the earth. Pickering's diameter, deduced from photometric observations of the satellite on the assumption that its albedo was equal to that of the primary, would involve a density nearly four times that of the earth. It would seem clear, therefore, that Titan possesses a much greater density than Saturn, but that its surface is less highly reflective.

NAMES OF MINOR PLANETS.—Minor planet No. 276 has been named Adelheid, and No. 278 Paulina.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1888 *AUGUST* 12–18.

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on August 12

Sun rises, 4h. 43m. ; souths, 12h. 4m. 43·8s. ; sets, 19h. 26m. : right asc. on meridian, 9h. 30·2m. ; decl. 14° 47′ N. Sidereal Time at Sunset, 16h. 53m.

Moon (at First Quarter August 14, 17h.) rises, 10h. 14m. ; souths, 16h. 8m. ; sets, 21h. 49m. : right asc. on meridian, 13h. 34·5m. ; decl. 4° 16′ S.

Planet.	Rises.	Souths.	Sets.	Right asc. and declination on meridian.
	h. m.	h. m.	h. m.	h. m. ° ′
Mercury..	3 29 ...	11 18 ...	19 7 ...	8 43·5 ... 19 18 N.
Venus ...	5 29 ...	12 41 ..	19 53 ...	10 6·4 ... 13 11 N.
Mars ...	12 33 ...	17 9 ...	21 45 ...	14 35·6 ... 16 38 S.
Jupiter ...	13 50 ...	18 13 ...	22 36 ...	15 40·0 ... 18 50 S.
Saturn ...	3 51 ...	11 31 ...	19 11 ...	8 56·4 ... 18 1 N.
Uranus ...	9 50 ...	15 28 ...	21 6 ...	12 53·7 ... 5 4 S.
Neptune..	22 50*...	6 37 ...	14 24 ...	4 1·8 ... 18 59 N.

* Indicates that the rising is that of the preceding evening.

ug.	h.	
13 ...	21 ...	Mars in conjunction with and 6° 49′ south of the Moon.
14 ...	4 ...	Mercury in conjunction with and 0° 39′ north of Saturn.
15 ...	0 ...	Jupiter in conjunction with and 4° 7′ south of the Moon.

Variable Stars.

Star.	R.A. h. m.	Decl. ° ′		h. m.	
λ Tauri...	3 54·5 ...	12 10 N. ...	Aug. 12,	3 12	*m*
			,, 16,	2 4	*m*
R Comæ	11 58·5 ...	19 25 N. ...	,, 12,		*M*
S Virginis	13 27·2 ...	6 37 S. ...	,, 18,		*m*
δ Libræ	14 55·0 ...	8 4 S. ...	,, 16,	23 0	*m*
U Coronæ	15 13·6 ...	32 3 N. ...	,, 15,	23 35	*m*
U Ophiuchi... ...	17 10·9 ...	1 20 N. ...	,, 14,	2 2	*m*
			,, 14,	22 10	*m*
R Scuti	18 41·5 ...	5 50 S. ...	,, 15,		*m*
β Lyræ...	18 46·0 ...	33 14 N. ...	,, 13,	3 0	m_2
R Lyræ	18 51·9 ...	43 48 N. ...	,, 18,		*m*
T Sagittarii... ...	19 9·8 ...	17 10 S. ...	,, 12,		*M*
η Aquilæ	19 46·8 ...	0 43 N. ...	,, 14,	2 0	*m*
S Sagittæ	19 50·9 ...	16 20 N. ...	,, 16,	23 0	*m*
X Cygni	20 39·0 ...	35 11 N. ...	,, 18,	2 0	*m*
T Vulpeculæ ...	20 46·7 ...	27 50 N. ...	,, 12,	0 0	*m*
δ Cephei	22 25·0 ...	57 51 N. ...	,, 15,	4 0	*M*
			,, 18,	22 0	*m*

M signifies maximum ; *m* minimum ; m_2 secondary minimum.

Meteor-Showers.

	R.A.	Decl.	
Near γ Andromedæ ...	25° ...	42° N. ...	Swift ; streaks.
The *Perseids*	60 ...	56 N. ...	,, ,,
Near λ Persei	60 ...	50 N. ...	,, ,,
,, ζ Aurigæ	73 ...	41 N. ...	,, ,,
,, δ Draconis	290 ...	70 N. ...	Swift ; short.

THE SCIENTIFIC VALUE OF VOLAPÜK.

THE Committee appointed by the American Philosophical Society, on October 21, 1887, to examine into the scientific value of Volapük, presented the following Report at the meeting of the Society held on January 6, 1888 :—

Your Committee proposes, first, to consider the desirability of a universal language ; secondly, what should be its characteristics ; and, thirdly, whether that invented by the Rev. Mr. Schleyer, called by him Volapük, meets the requirements.

I.—That in the vastly increased rapidity of interchange of thought in modern times, some general medium of intercommunication would be welcome, is unquestioned. Wherever there are close commercial relations between nations speaking different tongues, such media are sure to arise from the necessities of daily life. Thus, the Lingua Franca in the Mediterranean, and "pigeon English" in the Chinese ports, are dialects which have sprung out of the urgency of business needs. These mixed languages are called "jargons," and have a very high interest to the scientific linguist, as illustrating the principles of the evolution of human speech. The English language is a jargon of marked type, and illustrates what was stated by W. von Humboldt early in this century, that from such crossings and mingling of tongues are developed the most sinewy and picturesque examples of human language. This consideration shows that in adopting or framing a universal language we need not hesitate to mould it from quite diverse linguistic sources.

The presence of a number of these jargons in different parts of the world testifies to the desirability for some one simple form of discourse which could be of general adoption. Another and higher testimony to the same effect is the need now frequently and loudly expressed for a uniform terminology in the sciences. For many years it has been urged, both in this country and in Europe, that the neologisms required by the sciences be derived according to a uniform plan from the Greek, and that those heretofore obtained from Greek or Latin be brought into one general form. There is no practical difficulty about this except that which arises from the Chauvinism of some nations which are blinded by egotism or narrow notions to the welfare of the whole. Such a tendency is observable in Germany, a country once noted for its cosmopolitan sympathies. Its medical teachers, for example, have of late frequently dismissed the terms of their science derived from the Latin and Greek, in order to substitute in their place long, awkward, and inharmonious Teutonic compounds. No effort at a uniform international scientific terminology can be successful if the learned in each nation be governed by national prepossessions.

Another obstacle to a universal tongue, and which at the same time is a cogent argument for the adoption of one, is the sentimental love of local dialects and forms of speech by those who have imbibed them in infancy. To-day there are active Societies organized for the preservation of the Welsh, the Armorican, the Basque, the Finnish, and the Flemish. For many generations nearly all learned writings in Europe were in Latin. In the eighteenth century the Latin threatened to be superseded by the French. The Transactions of the Academy of Sciences of Berlin were in French ; so were the articles by the Russian Professors ; and in the earlier decades of the present century French prevailed in the Reports of the Royal Northern Society of Antiquaries, and in most scientific publications in Slavic and Northern Teutonic countries. This is the case no longer. Every little principality claims that it should print what it has to tell the world of science in its own dialect, and claims that the world of science should learn this dialect. Thus we have on the list of our scientific exchanges publications in Roumanian and Bohemian, in Icelandic and Basque, in Swedish and Hungarian, in Armenian and modern Greek, in Japanese and in Portuguese, without counting the more familiar tongues. Even a linguist by profession, such as Max Müller, has exclaimed against the very Babel, the confusion of tongues, which exists in modern scientific literature. He has sounded an earnest appeal to the learned writers of the world to express themselves in one of the half-dozen languages which every man of wide education is supposed to read—to wit, the English, French, German, Spanish, Italian, or Latin.

But even with the advantage of a well-developed international scientific terminology, it is a good deal to ask of a student of science that he should spend the time to acquire a reading knowledge of these six tongues. In many cases it is wholly impossible for lack of time. But time could always be

spared to learn one language, if that were enough, particularly if this one were exceptionally simple and easy in its grammar.

Again, the commercial and travelling world demands one tongue only, in addition of course to that which its members learn in infancy, a tongue facile to acquire, and adaptable to their peculiar wants. The time is not far off when one system of weights, measures, and coinage, one division of time, one code of international law, one mode of quarantine and sanitation, one costume, will prevail throughout the civilized world, and along with this unification of action must and will come a unification of speech. It is not only desirable, it is certain to arrive; and, as beings of intelligent self-consciousness, looking before as well as after, it becomes us to employ our faculties to direct the course of events so that this one universal language be not left to blind chance, but be framed and adopted of deliberate choice, and with the wisest consideration.

II.—Convinced, therefore, that the time is ripe for the promulgation of a general form of speech for the civilized members of the race, we will now inquire what should be the requirements of such a tongue to merit the recommendation of this Society.

We begin by the observation that the Aryan stock is now, and has been for 2000 years, the standard-bearer of the civilization of the world; hence, a universal language should be based upon the general linguistic principles of that stock. In the Aryan stock the six principal living tongues in the order of their importance and extent may be ranged as follows: English, French, German, Spanish, Italian, Russian. It should be the aim of the proposed general tongue to ally itself to these somewhat in the order noted, as thus being more readily acquired by the greater number of active workers in the world at the present time.

The elements of all languages arrange themselves to the linguist under three headings—phonetics, grammar, and lexicography; in other words, the vocal, the formal, and the material characteristics of the tongue; and under these three headings we will sketch the traits which should make the projected universal language.

(1) *Phonetics.*—We believe all will assent to the following propositions:—

The orthography of the universal language should be absolutely phonetic.

Every letter in it should always have the same sound.

This sound should be one common to all the leading Aryan languages, and hence present no difficulty to a person speaking any one of them.

Diphthongs, digraphs, and double consonants should all be omitted as misleading.

The meaning should never depend on tone, accent, quantity of vowels, nor rising and falling inflections of the voice. All these are inadequate and unnecessary expedients of the linguistic faculty.

The vowels should be limited to the five pure vowels: *a*, *e*, *i*, *o*, *u*, pronounced as in Italian, and all impure or modified vowel sounds, as the German *ä*, *ö*, *ü*, the French *u*, the English *u* (as in *use*), *o* (as in *not*), and the neutral vowel *u* (in *but*) should be discarded. All the Aryan tongues named possess the five pure vowels, but not all the impure and neutral vowels.

In the consonantal scheme all gutturals, aspirates, lisps, and nasals should be omitted. Thus, the German *ch*, soft or hard, the Spanish *z*, the English *h* and *th*, the French *n*; and likewise all double consonantal sounds, like the Spanish *ñ*, *ll*, *rr*, the German *kn*, *pf*, the Russian *schtsch*, the Italian *zz*, *cc*, &c., should find no place. Of all the Aryan languages the pure Castilian Spanish comes the nearest to such an ideal phoneticism, and it approaches very near indeed, a few consonantal heresies and the accent being its only drawbacks.

In the written alphabet of such a language there should be, and there would be no occasion for, any diacritical marks whatever. The so-called Latin or Roman handwriting and type should be employed, but with the omission of every sign which would require the writer to take his pen from the paper in the middle of a word, or else return to it in order to complete it. Hence the *i* should have no dot (as is the case in German), nor the *j*, and the *t* should not be crossed. No accents should be needed, and no apostrophes.

The sounds of the language should not only be easy, they should also be fairly agreeable to the ear; and combinations should be sedulously avoided which in any of the leading tongues have indecorous or degrading associations.

Brevity is of great importance, and each word should be reduced to its simplest discriminative sound, consistent with sonorousness and lucidity.

(2) *Lexicography.*—The vocabulary of the universal language should be based primarily on the vocabulary which is common to the leading Aryan tongues. There are 1500 words in German which are almost or quite the same in English; there are more than this number common to English, French, Italian, and Spanish. A selection should be made from these similar or identical word-forms as the foundation of the lexicon. At least a thousand words in common use will be found to be the same in all these languages, when we allow for the operation of simple and well-known phonetic laws. Let the learner be taught these laws, and he will at once know a good share of all the more usual terms of daily intercourse in this new language, and he will pronounce them correctly without a teacher, because it will contain no sound which is strange to his ears, and each word would be spelled as it is pronounced.

This existing common property of words, once assorted and presented in the orthography above set forth, would form one element of the lexicon; another will be those words obtained from an international scientific terminology, to be decided upon by the Committees of International Congresses, appointed for that purpose.

Commercial and business terms are already largely the same, and there would be little difficulty in obtaining a consensus of opinion about them which would prevail, because it is of direct pecuniary advantage to business men to have such a uniformity.

There remain the terms in art, literature, poetry, politics, imagination, &c., to be provided for. But in the opinion of this Committee it does not seem desirable at this time to urge the formation of a vocabulary which would be exhaustive. Much of it should be left to the needs of the future, as observed and guided by the International Committees who should have the care and direction of the universal tongue. These Committees should, by common consent, hold the same relation to it that the French Academy has, in theory at least, to the French language, enlarging and purifying it by constant and well-chosen additions. As in France, each writer would enjoy the privilege of introducing new terms, formed in accordance with the principles of the tongue, and such terms would be adopted or not, as they should recommend themselves to other writers in the same field.

(3) *Grammar.*—By far the greatest difficulty is presented by the formal or grammatical features of such a proposed tongue.

We may best approach this part of our task by considering how the grammatical categories, or "parts of speech," as they are called, are treated in the various Aryan tongues, and selecting the simplest treatment, take that as our standard.

It may indeed be inquired whether in the grammar we might not profitably pass beyond the Aryan group, and seek for simpler methods in the Semitic, Turanian, African, or American languages. But it is a sufficient answer to this to say that there is no linguistic process known to these remote stocks but has a parallel in some one of the Aryan dialects; and if such a process is very slightly developed in these dialects, this is probably the case because such a process has been found by experience to be unsuited to the modes of Aryan thought.

Returning to the grammatical categories or parts of speech, we find them usually classified as nine, to wit: articles, noun, pronoun, adjective, verb, adverb, preposition, conjunction, interjection.

The last of these, the interjection, is of no importance; and as for the first of them, the article, we find that the Latin and the Russian move along perfectly well without it, and hence we may dismiss it, whether article definite or article indefinite, as needless in the universal language.

The adjective in Latin has gender, number, and case, and, in most living Aryan languages, has number and gender; but in English it has neither, and, therefore, true to the cardinal principles of economy in the formal portions of speech, in the universal language it should have neither. More than this, in colloquial English and German, and always in English in the comparative degree, there is no distinction between the adjective and the adverb; and upon this hint we perceive the inutility of the distinction and dismiss it as operose only. The comparison of adjectives should be by words equivalent to *more* and *most*, as is practically the case in the Romance languages, and never by comparative and superlative terminations, as in English and German, as our endeavour should always be to maintain the theme unchanged.

This reduces our nine parts of speech to six, which are proved to be enough, by the facts quoted.

The noun in German undergoes changes for gender, number, and case. Of these the gender in all Aryan tongues, except English and modern Persian, is an absurdity, without application to the object, and a most serious impediment to learners. Grammatical gender, therefore, should be absolutely dismissed, and material gender expressed by the feminine adjective of sex, as in English and most American languages (bear, she-bear, rat, she-rat, &c.).

The Greek has a singular, a dual, and a plural number. The dual has dropped out of modern tongues, and in many instances the plural is grammatical only and not material. Indeed, as in most American languages, so often in English and German, the plural form is not used even when the plural number is meant. Thus, we say, ten head of steers, six dozen herring, sechszehn Stück Cigarren, sechs Uhr Abends, &c. It is probable, therefore, that both gender and number could be usually dispensed with in nouns.

With regard to the case of nouns, it will be observed that the tendency of all the Teutonic and Romance languages has been to get rid of them: French and Spanish have succeeded completely; the English retains the genitive, the German the nominative, genitive, dative, and accusative, in some instances. The cases have been supplied by the use of pronouns and prepositions, and we shall be wise to respect this tendency as indicative of linguistic progress. It is historically clear that to attempt to restore the case-endings of nouns would be to steer directly against the current of linguistic evolution. There has even been an effort both in English and German to dispense with the genitive by substituting a possessive pronoun for the case-ending, as "John his book," "Ludwig sein Pferd"; while the Berlin dialect of the lower classes has often but one termination for both genitive and dative, where pure German has two.

The use of the possessive pronoun to indicate the genitive is simple and logical; it prevails in most American languages and most jargons; and is quite adapted to the end. In fact, some dialects, such as the French Creole of Trinidad, Martinique, and St. Thomas, contain no pronominal adjectives, and make out very well by placing the personal pronoun, like any other attributive case, after the noun, as *liv li*, "his book," literally, "book he." It might be queried whether the universal language would not gain in ease and simplicity by adopting this method of placement.

The dative, or *régime indirecte*, could be supplied in a similar manner by a pronoun in an oblique form. There is no necessity for more than two oblique cases of the pronoun, and they can be added to all nouns as a substitute for prepositions, when needed for clearness.

The pronouns of the modern tongues, and especially of their colloquial dialects, demonstrate that the relative, interrogative, and demonstrative forms can be blended without loss of lucidity. The German *der*, the English *that*, are both relative and demonstrative; the French *qui* and *ça* are both relative and interrogative in Creole.

The reflexive pronoun is used very unnecessarily in most modern Aryan tongues. There is no logical propriety in the French *Je me casse le bras*. The use of such a form should be greatly restricted.

The verb has tense and mood, number and person. It is conjugated in all Aryan languages, sometimes regularly, sometimes irregularly, and it has many forms. In studying its history, however, no one can overlook its steady tendency towards simplification of the form of the theme and the adoption of the periphrastic method of conjugation, or that by auxiliaries. By this process the verb loses all inflections and is reduced to a single form; person and number are expressed in the subject, tense, and mode by auxiliaries. This should be the process adopted by the universal language, with perhaps the exception that the simple past and future might be expressed by terminations, every verb being absolutely regular. The future termination is now lost in English and German, and even the past termination is often dispensed with in both tongues, as "I give," "I did give," "ich that geben"; but as both are vigorous in the cultivated Romance tongues, these formal elements might be conceded.

A very delicate question relates to the substantive verb "to be." Shall we omit it or express it? The Latin rarely introduces it, and there are numerous tongues in which it has no equivalent. On the other hand, modern Aryan speech has developed it markedly; the Spanish has its *ser* and *estar*, the German its *sein* and *werden*, expressive of shades of meaning included in our verb "to be." This prominence of the expressions for existence seems to be connected with marked psychological advances, and a ripening self-consciousness, as has been lately set forth by a profound French critic of language, M. Raoul de la Grasserie. We should be inclined, therefore, to respect this expression, and allow it in a universal language the prominence it enjoys in most Aryan tongues of modern type.

The prepositions offer great difficulties in modern languages. The most of them can be omitted by making all verbs which have an active meaning govern their object directly, and have the direct object follow the verb and the indirect object placed later in the sentence. The phrase, "Give to the child a spoon," would be just as intelligible in the form "Give spoon child," if we remember that the direct precedes the indirect object.

The simplification of grammatical forms here proposed involves an equal simplification in syntax, and this is an enormous gain. But it involves also the loss of freedom of position, so conspicuous a feature in Latin, and by some so highly esteemed. But philosophically considered, this freedom of position is solely a rhetorical and artistic gain, not a logical superiority. Grammarians even of the classical tongues are perfectly aware that there is a fixed logical arrangement of words in a sentence, and this, and this alone, is the only arrangement which a universal language should adopt. This arrangement may be briefly given as follows: subject before predicate, noun before its adjective, verb or adjective before qualifying adverbs, immediate object before remote object. This is the logical course of thought, and should be the universal form of expression. It was a dubious advantage to the Greeks and Latins that their numerous inflections permitted them to disregard it.

Those languages which rely largely on position obtain rhetorical grace by a recognized value assigned to alterations of position; and this would apply equally to the scheme proposed.

Other questions will arise in the projecting of a universal language. Shall we adopt postpositions as well as prepositions? Shall we indicate inflections by internal vowel changes? Shall we have free recourse to affixes, suffixes, and infixes? Shall we postfix conjunctions, like the Latin? Shall we manufacture entirely new roots from which to form new words and derivatives?

To all these questions your committee replies with an emphatic negative. All such processes are contrary to the spirit which has pervaded the evolution of the Aryan languages for the last two thousand years, and their adoption would violate the indicated rules for the formation of a universal Aryan speech.

III. In applying the principles which have been above set forth to the creation of the Rev. Johann Martin Schleyer, we find something to praise and much to condemn in his attempt.

Mr. Schleyer first published a sketch of his proposed universal language in 1878, and the first edition of his grammar in 1880. It has been welcomed with applause in Germany, and efforts have been made with some success to introduce it into France, England, and America.

His scheme is evidently the result of conscientious labour and thought, and he manifests a just appreciation of the needs of the time; but unfortunately the theory of construction he has adopted is in conflict with the development of both the Teutonic and Romance languages, and full of difficulties to the learner.

Beginning with its phonetics, we find that he has retained the impure German modified vowels *ä, ö, ü*, the French *j* (*dsch*), as well as the aspirated *h* or rough breathing. He has eight vowels and nineteen consonants where five vowels and sixteen consonants should suffice; elsewhere he extends his alphabet to thirty-seven letters. He also introduces various diacritical marks indicating accent, tones, vocal inflection, and quantity, all of which we consider needless and obstructive. Double consonants are numerous, and the Volapük is both written and printed with underscoring and italic letters, necessary to facilitate its comprehension.[1]

The lexicography is based largely on the English, about 40 per cent. of the words being taken from that tongue, with phonetic modifications. These modifications do not regard the other Aryan languages, and various sounds of the Volapük alphabet could not be pronounced by a member of any Aryan

[1] These remarks are based upon the seventh edition of Schleyer's "Mittlere Grammatik der Universalsprache Volapük" Konstanz, 1887).

nation without special oral teaching. This we regard as a fatal defect.

Moreover, many words are manufactured from entirely new radicals, capriciously, or even fantastically formed, and this we condemn.

The article is omitted, which is well; but the nouns are inflected through a genitive, dative, and accusative case, and a plural number. The signs of these cases are respectively *a, e, i*, and of the plural *s*.

Diminutives, comparatives, and superlatives are formed by prefixes and suffixes, and on the same plan adverbs are formed from adjectives, and adjectives from nouns. Thus, *silef*, silver; *silefik*, silvery; *silefikům*, more silvery; *silefikün*, most silvery; *silefiko*, silverly. It will be observed that, while this process is not dissimilar to that once frequent in the Aryan stock, it is not analogous to that which the evolution of that stock indicates as its perfected form.

In the conjugation the subject follows the verb, *bin—ob*, I am; where *bin* = am, *ob* = I. This we object to as contrary to the logical arrangement of the proposition. We are surprised to see the German third person plural (*Sie*) retained by the author as a "courteous" form. It should be the first duty of a universal language to reject such national solecisms.

The tense is indicated by prefixes *a, e, i* for the imperfect, perfect, and pluperfect active, *o* and *u* for the two futures.

The passive voice has the prefix *p*, the subjunctive by the suffix *la*, the optative and imperative by the suffix *ös*, the infinitive by the suffix *ön*. Abstracts are formed by adding *äl*, as *mon*, money; *monäl*, love of money, avarice. These suffixes are to be placed in fixed relations to the root, and hence often become infixes.

The excessive multiplication of forms lends to Volapük an appearance totally un-Aryan. The verbal theme is modified by sixteen suffixes and fourteen prefixes. There are a "durative" tense, and a "jussive" mood, conjunctive, optative, gerund, and supine forms, all indicated by added syllables, reminding one of the overloaded themes of Turanian tongues. This mechanism is not only superfluous, but if any lesson may be learned from the history of articulate speech, it is precisely the opposite to what the universal language should and must be.

The meaning is largely derived from placement, as will be seen in the following example, in which *gudikos* is the neuter adverbial noun "goodness," das Gute; *plidos*, from English "please," the third singular indicative.

Gudikòs plidös Godi.
Goodness pleases God.
Plidos Gode gudik.
It pleases God the good (the good God).
Plidòs gudik Gode.
It pleases well God.

And so on. It is acknowledged by the author that obscurities may easily arise from these transpositions, and there is much dependence on accents and tones.

From this brief comparative examination of the evolutionary tendencies of the Aryan tongues and the scheme of a universal language as offered in the works of Mr. Schleyer, it is plainly evident that the two are in absolute opposition.

Volapük is synthetic and complex; all modern dialects become more and more analytic and grammatically simple; the formal elements of Volapük are those long since discarded as outgrown by Aryan speech; its phonetics are strange in parts to every Aryan; portions of its vocabulary are made up for the occasion; and its expressions involve unavoidable obscurities. With an ardent wish for the formation and adoption of such a universal tongue, and convinced as we are that now is the time ripe for its reception, we cannot recommend Volapük as that which is suited to the needs of modern thought. On the contrary, it seems to us a distinct retrogression in linguistic progress. Nor in this day of combined activities does it appear to us likely that any one individual can so appreciate the needs of civilized nations as to frame a tongue to suit them all. Such a task should be confided to an International Committee from the six or seven leading Aryan nationalities.

In conclusion, your Committee would respectfully suggest that it would eminently befit the high position and long-established reputation for learning of the American Philosophical Society, to take action in this matter, without delay, and to send an official proposition to the learned Societies of the world to unite in an International Committee to devise a universal language for business, epistolary, conversational, and scientific purposes. As the time once was when the ancestors of all Aryans spoke the same tongue, so we believe that the period is now near when once again a unity of speech can be established, and this speech become that of man everywhere in the civilized world for the purposes herein set forth.

Your Committee therefore offers the following resolution—

Resolved,—That the President of the American Philosophical Society be requested to inclose a copy of this Report to all learned bodies with which the Society is in official relations, and to such other Societies and individuals as he may deem proper, with a letter asking their co-operation in perfecting an international scientific terminology, and also a language for learned, commercial, and ordinary intercourse, based on the Aryan vocabulary and grammar in their simplest forms; and to that end proposing an International Congress, the first meeting of which shall be held in London or Paris.

D. G. Brinton, *Chairman*,
Henry Phillips, Jun.,
Munroe B. Snyder,
} *Committee.*

The following Supplementary Report was also read on the same occasion:—

The former Report having been recommitted, your Committee avails itself of the opportunity to explain more clearly the aim of the previous paper, to meet some of the objections offered against particular statements, and, at the request of several members, to enlarge the scope of the Report, so as to embrace a brief consideration of the two other universal languages recently urged upon the public, the "Pasilengua" of Steiner, and the "international language" of Samenhof.

The aim of the Committee was strongly to urge the desirability of taking immediate steps to establish a universal language, both for learned and general purposes. These steps, it asseverated, should be taken by the learned world as a body; the form of language adopted should be indorsed by the scientific Societies of all nations; by their recommendation it should be introduced into schools and Universities, and competent private teachers would soon make it familiar to all who would have occasion to use it. The Report distinctly states that it is in nowise expected that this international language will supplant any existing native tongue. It is to be learned *in addition* to the native tongue, and not *in place* of it.

The aim of the grammatical portion of the Report was simply to maintain three theses: first, that the pronunciation of the proposed tongue should be so simple that it could be learned by anyone speaking an Aryan language, without the necessity of oral instruction; secondly, that its grammar should be simplified to the utmost; and thirdly, that its lexicon should be based on the large common property of words in the Aryan tongues.

Your Committee repeats and insists that these are the indispensable requisites to any such proposed international tongue. It does not insist that the individual suggestions and recommendations contained in the Report should be urged at all hazards. They were advanced rather as hints and illustrations, than as necessary conditions. Nevertheless, they were not offered hastily, and your Committee desires to refer to some of the main arguments advanced against them. This it is prepared for the better, through the complaisance of Profs. Seidensticker and Easton, who have forwarded to the Committee, at its request, abstracts of their remarks.

Both these very competent critics attack the principle of deducing the grammar of the proposed language from the latest evolution of Aryan speech, to wit, the jargons. Prof. Seidensticker accuses such a grammar of "poverty," and adds: "A higher organism is of necessity more complex than a lower one." Prof. Easton denies that the later is the better form; or, to use his own words, "that the change from an inflected to an analytic tongue marks an advance in psychologic apprehension."

These criticisms attack a fundamental thesis of your Committee, and as they doubtless express the views of very many, they must be met.

In our opinion, they rest upon a radical misconception of the whole process of linguistic evolution. The crucial test of the development of language is that the sentence shall express the thought intended to be conveyed, and *nothing more*. When this can be attained simply by the order of words in the sentence, without changes in those words, such changes are not merely useless, they are burdensome, and impede the mind. All paradigmatic inflections, whether of nouns, adjectives, or verbs, are relics of lower linguistic organization, of a barbaric condition of speech, and are thrown aside as useless lumber by the active

linguistic faculty in the evolution of jargons. Compare a simple Latin sentence from Cicero, with its translation into English, which is a jargon of marked type, and note how much is dropped, and with what judicious economy: "*Romanis equitibus literæ afferuntur*"—"Letters are brought to the Roman knights." One word here will serve to illustrate all. In Latin the speaker must think of the adjective *Romanis* as masculine, not feminine, or neuter; as plural, not singular; as a dative, not a nominative, accusative, or vocative form; as agreeing in all these points with the noun it qualifies; and finally, as of the first, and not of the second, third, or of some irregular declension. All this needless labour is saved in the English adjective *Roman* by the method of position or placement. And so it is with every other word in this sentence. The evidence, both from theory and from history, is conclusive that the progress of language, linguistic evolution, means the rejection of all paradigms and inflections, and the specialization of the process of placement.

Prof. Easton maintains that this method (that of placement) "introduces an element of great difficulty into the language," and also doubts the acceptance of the logical order stated in the Report.

To the first of these objections the obvious answer is that the method of placement is that uniformly adopted in all jargons and mixed tongues, which is positive proof that it is the least difficult of any method of expressing relation. As to the logical order referred to by the Committee, it is surprising that any exception should be taken to it, as it is that stated in the common classical text-books.

Some related minor points remain to be noticed. In opposing vocal inflection, signs, and accents, in their Report, the Committee referred only to the written, not to the spoken language. The phonetic formation proposed is insisted upon only to the extent that no sound should be introduced which would be strange to the six leading Aryan languages. The substitution of placement for prepositions, which they recommended, was meant as illustrative merely. The particular statement that the Berlin dialect (of the lower class) has but one termination for both genitive and dative is upon the authority of Dr. and Mrs. Seler, of Berlin, the former a professed linguist, the latter born and raised in that city. The question whether, in the German expression, *sechs Uhr Abends*, the word *Uhr* is a singular form with a plural meaning, is contradicted by Prof. Seidensticker; but, in view of the strictly analogous Spanish expression, *las seis horas de la tarde*, the Committee maintains its original opinion.

Passing from these specific animadversions, there were some general objections which should be answered. Various speakers maintained that the project of an international language is impossible of realization; others asserted that it was unnecessary; others that, even if realized, such a tongue could have no figurative or artistic wealth of resources.

To these strictures it is replied that within eight years Volapük is claimed to have acquired 100,000 students; within a month it has attracted attention all over the United States; within a week a number of German merchants have announced to their foreign correspondents that in future it will be used in their business communications. If this is the case with so imperfect a language, backed by no State, no learned body, not even by the name of any distinguished scholar, what would be the progress of a tongue perfect in adaptation, and supported by all these aids to its introduction? In a decade it would be current among 10,000,000 people. That it would be barren in figurative meanings, or sterile in the expression of the loftier sentiments, is inconceivable, because, formed though it would be of deliberate purpose, the inherent, ever-active linguistic faculty of the race would at once seize upon it, enrich it, mould it, and adapt it to all the wants of man, to the expression of all his loves and hates, his passions and hopes.

Your Committee closes with a reference to the remaining two tongues now claimants for universal adoption.

The "Pasilengua" (*Gemeinsprache*, "Tongue of All") was introduced by P. Steiner, in 1885, with a small grammar and dictionary, published in German. The "international language" of Dr. L. Samenhof, of Warsaw, is an arrival of the present year, and is explained by him in a small volume, issued in French, in his native city, under the pseudonym of "Dr. 'Esperanto."

Both these have pursued the correct path in the formation of their vocabulary; they both proceed on the plan of collecting all words common to the Aryan languages, changing their form as little as possible consistently with reducing them to an agreeable phoneticism, and when the same word has acquired diverse significations, selecting that which has the broadest acceptation. The plan of Dr. Samenhof is especially to be recommended in this respect, and may be offered as an excellent example of sound judgment. It is remarkable, and remarkably pleasant, to see how easy it is to acquire the vocabulary of either of these writers, and this is forcible testimony how facile it would be to secure an ample and sonorous stock of words, practically familiar to us already, for the proposed universal tongue.

Unfortunately, the alphabets of both employ various diacritical marks and introduce certain sounds not universal to the leading Aryan tongues. These blemishes could, however, be removed without much difficulty.

It is chiefly in the grammar that both err from the principles strenuously advocated by your present Committee. The Pasilengua has an article with three genders, *to*, *ta*, *te*, corresponding to the German *der*, *die*, *das*; it has also three case-endings to the noun, besides the nominative form, which itself changes for singular and plural, masculine and feminine. In the verb the tenses are formed by suffixes, six for the indicative, four for the subjunctive; while a number of other suffixes indicate participles, gerunds, imperatives, &c.

In the same manner, Dr. Samenhof expresses the relation of the elements of the proposition in the sentence "by introducing prefixes and suffixes." "All the varying grammatical forms, the mutual relation of words to each other, are expressed by the union of invariable words" ("Langue Internationale," p. 13). He acknowledges that this is "wholly foreign to the construction of European [he means Aryan] languages," but claims that it yields a grammar of such marvellous simplicity that the whole of it could be learned in one hour. In reality, it is what is known to linguists as the agglutinative process, and is found in the Ural-Altaic tongues, in high perfection.

It will be seen at once that the grammatic theories of both these tongues are directly in opposition to that advocated in the present and the previous Reports. These are both distinct retrogressions to an earlier, less developed, and more cumbersome form of language than that which dispenses with paradigms and inflections of all kinds.

Nevertheless, these repeated efforts go to show that an international language is needed, that it is asked for, that it is coming, and justify the propriety of this Society, which, as far back as the second decade of this century, marked itself as a leader in linguistic science, taking the van in this important and living question.

After discussion, during which amendments to the resolution originally proposed by the Committee were offered by Prof. Cope and Mr. Dudley, the Society adopted the following resolution by a unanimous vote—

Resolved,—That the President of the American Philosophical Society be requested to address a letter to all learned bodies with which this Society is in official relations, and to such other Societies and individuals as he may deem proper, asking their co-operation in perfecting a language for learned and commercial purposes based on the Aryan vocabulary and grammar in their simplest forms; and to that end proposing an International Congress, the first meeting of which shall be held in London or Paris.

THE LICK OBSERVATORY.

WE reprint from the *Daily Alta California* the following extracts from a private letter from Prof. Holden to a gentleman in San Francisco, giving details regarding the first astronomical observations made at the Lick Observatory:—

"The Lick Observatory is beginning to present a very different appearance, both by night and by day, from the one it lately had during its period of construction. At night the windows which have been so long dark show the lamps of the astronomers gleaming through them. The shutters of the observing slits are open, and the various instruments are pointed through them at the sky. The actual work of observing has begun, and the purpose for which the Observatory was founded—to be 'useful in promoting science'—is in the way of being accomplished. Prof. Schaeberle, late of Ann Arbor, has commenced the long task which has been assigned to him—namely, to fix with the very highest degree of precision possible to modern science, the position of the 'fundamental stars' with the Repsold meridian circle. The time-service for railway use is now conducted by

Mr. Hill (late assistant to Prof. Davidson), which leaves Mr. Keeler free to make the necessary studies of the great star spectroscope, which is one of the most important accessories of the 36-inch equatorial. Mr. Barnard is assiduously observing comets and nebulæ with the fine 12-inch equatorial, and getting the photographic appliances in readiness to be used with the great telescope. He has already discovered twenty new nebulæ, found in the course of his sweeps for new comets. To show you some of the advantages of our situation here, I may tell you that Prof. Swift, of Rochester, has a fine 16-inch equatorial by Alvan Clark, and has discovered many faint nebulæ by its use. Two nights ago Mr. Barnard was examining some of these excessively faint objects by means of the 12-inch telescope (which gives only a little more than half the light of Prof. Swift's), and in the field of view where Prof. Swift had mapped only one nebula Mr. Barnard found three, two being, of course, new. This is due not only to the observer's skill and keenness of eye, but in great measure to the purity and transparency of our atmosphere here.

"The Eastern astronomers have given up the observation of Olbers's comet, which is now only about 7/100 as bright as last year, but Mr. Barnard has succeeded in following it up to last night, when it finally became too faint to be seen even here. These observations, which are several weeks later than those of other Observatories, are of real value, as they determine a larger arc of the comet's orbit, and enable its motion to be fixed with a much higher degree of accuracy. Mr. Keeler is just reducing his observations of the faint satellites of Mars, made with the large telescope during the past months. You can gain some sort of an idea of the immense advantage of the great telescope in such observations, when I tell you that the brightness of the satellites as observed by him was only about one-sixth of their brightness at the time of their discovery. We can, then, make satisfactory observations of objects which are *six times fainter* than those very minute satellites of Mars were when Prof. Hall discovered them in 1877 with the great telescope at Washington. I am becoming familiar with the performance of the large telescope and learning how to get the very best work from it. It needs peculiar conditions; but when all the conditions are favourable its performance is superb. I am, as you know, familiar with the action of large telescopes, having observed for many years with the great refractor at Washington, but I confess I was not prepared for the truly magnificent action of this, the greatest of all telescopes, under the best conditions. I have had such views of the bright planets (Mars and Jupiter), of nebulæ, the Milky Way, and some of the stars, as no other astronomer ever before had. Jupiter, especially, is wonderfully full of detail that I had not begun to see before. The disks of his moons can be readily noted in smaller telescopes; but here they are full and round, like those of planets. I am almost of the opinion that the curve of Jupiter's shadow might be seen on the surfaces, under favourable circumstances, when the satellites suffer eclipse. There is reason to believe that the satellites of Jupiter, like our own moon, present always the same face to their planet. This can be studied here to great advantage if the disks present any of the markings which are reported by other observers.

"The Milky Way is a wonderful sight, and I have been much interested to see that there is, even with our superlative power, no final resolution of its finer parts into stars. There is always the background of unresolved nebulosity on which hundreds and thousands of stars are studded—each a bright, sharp, separate point. The famous cluster in Hercules (where Messier declared he saw 'no star') is one mass of separate individual points. The central glow of nebulosity is thoroughly separated into points. I have been specially interested in looking at objects which are familiar to me in other telescopes and in comparing our views with the drawings made by Lord Rosse with his giant 6 foot reflector. Theoretically, his telescope should show more than ours, for his collected the most light. But the *definition* (sharpness) of his is far behind our own, as we constantly see. For example, the ring nebula in Lyra is drawn by Lord Rosse with no central star. At Washington, one small star can be seen in the midst of the central vacuity, but here we are sure of seeing three such at least. These are interesting on account of their critical situation in the nebula, not simply as stars.

"The great Trifid and Omega nebulæ are wonderful objects here. Not only is a vast amount of detail seen here which cannot be seen elsewhere, but the whole aspect of them is changed. Many points that are doubtful with other telescopes are perfectly simple and clear here. I have always considered that one of the great practical triumphs of this telescope would be to settle, once for all, the doubts that have arisen and that will arise elsewhere. Now, I am sure that we shall be able to do this, and in a way to end controversy.

"Of course you understand that the period of construction here is not yet quite over, though, I am thankful to say, it is nearly ended. We have been making our observations, so far, under great disadvantages, and now that we see the way out of most of them, and look forward to work uninterrupted by machinists and constructors, we begin to realize the opportunity. It really takes time to understand how to utilize it in the very best way. A great telescope is not like an opera-glass, which can be taken out of one's pocket, and which is at once ready for use. It is a delicate and a complicated machine, which demands a whole set of favourable conditions for its successful use. Every one of these conditions has to be studied and understood, so that it can be commanded and maintained. We have been busy night and day in this work, and in completing the thousand arrangements and contrivances which are essential in order to turn this vast establishment from a museum of idle instruments into a busy laboratory, where the inner secrets of the sky are to be studied. We feel sure now that in a comparatively short period we shall be in full activity. In the meantime every one of us is doing his best under the conditions.

"We expect to open the Observatory to visitors every Saturday night from 7 to 10 o'clock, beginning next Saturday, July 14.

"EDWARD S. HOLDEN."

SCIENTIFIC SERIALS.

Studies from the Biological Laboratory of Johns Hopkins University, vol. iv. No. 4, June 1888.—On the life-history of *Epenthesis mccraydi* (n. sp.), by W. K. Brooks, Ph.D. (plates 13–15). In June 1887, Dr. Brooks found at Nassau, in the Bahamas, a few specimens of a Hydromedusa belonging to the Eucopidæ, bearing upon each one of its four reproductive organs a number of Hydroid blastostyles from which young Medusæ were produced by budding; a method of reproduction which has no parallel among the Hydroids, if, indeed, it occurs elsewhere in the animal kingdom. While in their endless diversity the Hydromedusæ present nearly all imaginable phases of development, yet in all hitherto recorded cases the life-history of each species from the egg to the second generation of eggs is a history of progression, but this Nassau Medusa is an exception to the general rule; the bodies which are carried on the reproductive organs of the Medusa are true blastostyles, so that there is a recapitulation of larval stages without sexual reproduction. This remarkable form had on its first discovery been referred to Oceania, but is really an Epenthesis. The Medusæ carry on their reproductive organs campanularian Hydroid blastostyles, inclosed in chitinous gonangia. These blastostyles do not multiply by budding or from Hydroid cormi, although they produce Medusæ by budding. The ectoderm of the blastostyle is produced by ordinary gemmation, and is directly continuous with the ectoderm of the Medusa, but its endoderm has no direct communication with the medusal endoderm, its germ-cells arising by the process termed sporogenesis by Metschnickoff.—Observations on the development of Cephalopods: homology of the germ-layers, by S. Watase (plates 16 and 17). In this most important paper the history of the formation of the germ-layers is traced, and many disputed points are settled.—On the development of the Eustachian tube, middle ear, tympanic membrane, and meatus of the chick, by Dr. F. Mall (plates 18 and 19). Confirms Prof. His's demonstration, controverted by Fol and others, that the branchial clefts are not fissures.—On the branchial clefts of the dog, with special reference to the origin of the thymus gland, by Dr. F. Mall (plates 19–21).—On experiments with chitin solvents, by T. H. Morgan. Recommends the Labaraque solution (potassium hyperchlorite) as a solvent for chitin.

Notes from the Leyden Museum, vol. x. No. 3, July 1888.—Among the longer articles may be mentioned:—On the Erotylidæ of the Leyden Museum, by the Rev. H. S. Gorham. About seventeen are new, including four for which it has been necessary to make new genera.—On some new Phytophagous Coleoptera from Brazil, by M. Jacoby.—On the Shrews of the Malayan Archipelago, by Dr. F. A. Jentink.—On the habits and anatomy of *Opisthocomus cristatus*, by Dr. C. G. Young. In this paper there are no references to the various memoirs already published on the anatomy of this bird.—On some new or little-known Longicorns (Pachyteria), by C. Ritsema.—On birds from the Congo and South-Western Africa, F. Büttikofer.

Revue d'Anthropologie, troisième série, tome iii. troisième fasc. (Paris, 1888).—Report on the excavations made in the bed of the Liane in 1887 in laying the foundations for a viaduct, by Dr. E. T. Hamy. The mouth of this river, which is now filled with alluvial deposits, was in earlier times a vast estuary opening into the Channel; and in the recently completed excavations there has been found a mingled mass of animal bones, with metal and pottery fragments, belonging to all historic ages, from Roman times to our own, while the deep underlying strata recall, in their general character and appearance, Quaternary formations. Besides these remains, several pieces of a human skeleton have been found, including the cranium, which is considered by M. Hamy and other anatomists as belonging, in regard to its essential characteristics, to the oldest Quaternary cranial type. A slight degree of prognathism is the only feature of inferiority which it presents, and it in no way resembles the Negro or Negroid form. The remarkable elongation of all the bony parts in a vertical direction may be regarded as the special peculiarity of this skull, of which M. Hamy gives numerous measurements, based on the system adopted in the *Crania Ethnica*.—Continuation of an essay on the stratigraphic palæontology of man, by M. Marcellin Boule. The larger portion of this paper treats of the actual condition of palæontological research in England, and describes at length the numerous directions in which light has been thrown by recent British geologists on the effect of glacial action in determining the character and forms of the predominant geological features of the British Isles. The writer gives unqualified praise to the labours of Ramsay, Geikie, and others, lamenting, however, that in regard to numerous important points the views of the leading English palæontologists present great divergencies. In the second part of his essay M. Boule passes in review the results obtained by recent investigations of the traces existing in the Alps of recurring and intermittent glacial periods. In this inquiry he has made special use of Herr Penck's great work, "Mensch und Eiszeit" (1884), in which the strongest evidence is brought forward in proof of more than one advance and retrogression of glaciers in the valley of the Iller, and at other points of the Alpine range. These views have been confirmed by M. Blaas, and quite recently (1887) by M. Baltzer, and with few exceptions they have been generally adopted by Continental geologists; M. Falsan, Prof. Favre, of Geneva, and one or two others alone refusing to renounce the theory of one sole glacial period, while, however, they admit the possibility of the oldest glaciers having experienced more or less prolonged phases of advance and retreat.—The latest stages of the genealogy of man, by M. Topinard. This paper embodies the concluding and most important of the lectures delivered by the Professor at the Paris School of Anthropology. Beginning with the Lemuridæ, he treats of the grounds on which this animal family has been included by some, as Cuvier, under the Quadrumana, while Linnæus, Huxley, Broca, &c., class them with the Primates. To the latter view M. Topinard adheres, while he agrees generally with Prof. Huxley in including three groups under the Primates, viz. man, the Simians, and the Lemurians, the second group being separated into numerous divisions and subdivisions. M. Topinard's paper is interesting as a full and unbiassed exposition of the various hypotheses advanced by the leaders of modern biological inquiry as to the descent of man. While he freely expresses his personal aversion to the views of Vogt, which evidently point to the Ungulata as supplying the point of departure from which the primary source of man's descent emanated, he does ample justice to the great value of his labours, and acknowledges the benefit which he has derived from following the paths of inquiry inaugurated by the daring German physicist. Having minutely described the various anatomical characteristics which are common to man and to different mammalian families, he gives his reasons for believing that our descent is derived from the Simiadæ through a long series of intermediate forms of more or less strongly-marked anthropomorphic character, dating back to the Miocene age, when a divergence from the common type may have appeared, which, widening in the course of countless ages, has resulted in developing in man the perfect brain, and the maximum of differentiation in the extremities which give him his place in Nature.—On palæontology in Austria-Hungary, by M. M. Hörnes. The study of the prehistoric remains of their country is of recent date among Austrians, since the Anthropological Society of Vienna, the only one as yet incorporated by them, owes its origin to Rokitansky, and was only founded in 1870. Since that period, however, highly important results have been obtained from carefully conducted explorations in Carinthia and Carniola, where the discovery of vast burying-grounds and lacustrine stations has thrown much light on the condition and degree of civilization of primæval man in South-Eastern Germany. In Lower Austria almost all isolated hills and mountains present evidence of Neolithic occupation, many of them still retaining megalithic remains. Dr. Hörnes's article is especially interesting as showing what extensive, still almost untrodden tracts are being opened to palæontologists in different parts of the Slavonian and Czeck provinces of Austria; while his summary of the results already achieved, and his remarks on the ethnographic character of the primitive peoples by whom these regions were occupied in prehistoric times, throw considerable light on a hitherto obscure department of European palæontology.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 7.—"Note on some of the Motor Functions of certain Cranial Nerves (V, VII, IX, X, XI, XII), and of the three first Cervical Nerves, in the Monkey (*Macacus sinicus*)." By Charles E. Beevor, M.D., F.R.C.P., and Victor Horsley, B.S., F.R.S. (From the Laboratory of the Brown Institution.)

In the course of an investigation which we are making into the cortical representation of the muscles of the mouth and throat, we have experienced considerable difficulty in describing correctly the movements of these parts, especially when there was any question of bilateral action occurring.

On referring to text-books we failed to find any solution of this difficulty, and we therefore determined to make a few observations of the movements evoked by stimulating the several cranial nerves supplying this region in the monkey,[1] so as to have a definite basis whereon to ground our observations of the movements obtained by stimulating the cortex.

In the course of this work we have observed several facts which do not harmonize with the views hitherto generally received.

The results are summarized as follows:—

Method of Investigation.

The conclusions we have arrived at are based almost entirely upon the results obtained by exciting the respective nerves at the base of the cranial cavity after separating them from the bulb.

We have also stimulated the nerves outside the skull in the neck both before and after division.

In every case the animal was narcotized with ether. In all we have done eight experiments, and in every case we have operated on the same kind of monkey, *i.e. Macacus sinicus*.

The nerves were in each case raised up from their position and stimulated in the air by a faradic current through fine platinum electrodes, the area of the operation having been gently dried.

The current employed was from the secondary coil of an ordinary du Bois-Reymond inductorium, supplied by a 1 litre bichromate cell. The experiment was carefully begun with the secondary coil at a distance of 30 cm. from the primary, this interval being very rarely diminished to more than 15 cm. (zero being of course the point where the secondary coil completely overlaps the primary).

Further Observations respecting the Examination of each Nerve.

A. *Cranial Division.*

Vth Nerve.—Excitation of the motor root of the trigeminus evoked powerful closure of the jaws, and although the muscles of one side only were in action, the teeth were approximated without any lateral deviation of the lower jaw.

VIIth Nerve.—The motor distribution of the facial nerve has for the most part been well known for some time. However, we consider that, unfortunately, a very fundamental error respecting this distribution has crept into the text-books, it being supported by one anatomical authority following another, and, moreover, having been accepted by clinicians as an important aid in the differential diagnosis of facial paralysis. We refer to the supposed supply of motor fibres from the facial to the levator palati through the superficial petrosal nerve.

This idea,[2] upon which so much stress has been laid, is

[1] Previous observers having employed animals of lower orders.

[2] Without definitely supporting this view, Gaskell (Roy. Soc. Proc., vol. xliii. p. 390) shows that some large "somatic" nerve-fibres leave the facial nerve between its origin from the bulb and its exit from the stylo-mastoid foramen. He suggests that some of them may possibly form a nerve to supply the levator palati, but he leaves their real destination undetermined.

entirely hypothetical, as might have been shown at any time by stimulating the facial nerve in the skull, and observing the soft palate.

We have found that stimulation of the peripheral end of the divided facial nerve in the internal auditory meatus failed to cause even with most powerful currents the slightest movement of the soft palate, although the face was thrown into violent spasm. The true motor nerve supply of the levator palati is, according to our observations, the XIth nerve (*vide infra*).

IXth Nerve. Glossopharyngeal.—After exciting this nerve, in addition to the movements of the pharynx, which we attribute to the contraction of the stylopharyngeus, and possibly to the middle constrictor of the pharynx, we have observed certain movements of the palate, as follows :—(1) Stimulation of the nerve while beneath the stylo-hyoid ligament and uncut, gave in two instances elevation of the palate on the same side, and in one instance on both sides. We suppose that everyone will consider with us this movement to be reflex in origin, but we must add (2) that in one case we saw elevation of the palate to the same side when exciting the peripheral end of the cut nerve. In this latter case, perhaps, the result may be explained by the close neighbourhood of the pharyngeal plexus and the possible e cape of current thereto, and under any circumstances this is but a single exceptional observation, so that we lay no stress upon it. Finally we never saw movement of the soft palate when the glossopharyngeal nerve was stimulated within the cranial cavity.

Xth Nerve. Vagus.—In stimulating the uncut nerve outside the skull, below the level of its junction with the hypoglossal, rhythmical movements of swallowing were produced, which occurred at the rate of twenty-five times in thirty-five seconds.

In one observation all the constrictors of the pharynx were thrown into action, when the peripheral end of the cut nerve was stimulated outside the skull.

The rhythmical movements of swallowing obtained by stimulating this nerve must be due to, of course, the simple reflex, the stimulus acting on the nerve in the centripetal direction, and that this was the case is proved by the fact that no movement was obtained when the peripheral end of the cut nerve was stimulated inside the skull.

The superior laryngeal branch on being stimulated gave rhythmical movements of swallowing at the rate of seventeen times in fifteen seconds, but when the nerve was cut and its peripheral end stimulated, only very slight movement was produced in the larynx, evidently by contraction of the crico-thyroid muscle.

XIth Nerve. Accessory to Vagus.—In discussing the motor functions of the VIIth nerve, we stated that the hitherto received idea of the soft palate being supplied by the facial nerve was, according to our observations, entirely erroneous. We find that the levator palati is supplied entirely by the XIth nerve.[1] When the peripheral end of the cut nerve was stimulated inside the skull, elevation of the soft palate on the same side was invariably seen. The path by which the fibres from this nerve reach the palate is probably through the upper branch of the pharyngeal plexus.

XIIth Nerve. Hypoglossal.—When the entire nerve was excited outside the skull, just below the point where it is joined by the first cervical nerve, the tongue was flattened posteriorly on the same side, and the tip protruded also on the same side, while in no case was there any heaping up of the tongue.

At the same time the depressors of the hyoid bone were thrown into action, and in some cases this dragging downwards of the hyoid completely prevented the tongue from being protruded.

The movements described above were repeated without alteration when the peripheral end of the cut nerve was excited at the same place.

It must be particularly noted that the movements of the tongue were purely uni-lateral, and this was proved to be the case beyond doubt by two experiments, in which the tongue was divided longitudinally in the middle line to the hyoid bone, when the movements were seen to be entirely confined to the side stimulated.

When the cut nerve was excited within the skull a different result was obtained, the tongue was flattened behind, and protruded towards the same side, but there was no action in the depressors of the hyoid.

[1] I desire to add here that Dr. Felix Semon, in the course of some experiments (unpublished), performed in conjunction with myself, found that in the dog the levator palati was innervated by the XIth nerve.—V. H.

It has always been held that the depressors of the hyoid bone receive their motor nerve supply from the hypoglossal through the descendens noni, but, as will be shown further on, according to our observation, these muscles are supplied by the first and second cervical nerves, and it is only when the hypoglossal is stimulated below the point where it is joined by the branch from the first cervical nerve, that any movement is produced in the depressors of the hyoid.

B. *Spinal Division.*

Our observations of the motor functions of the first three cervical nerves as regards their influence on the hyoidean muscles have been made when the nerves have been excited—

(*a*) In the spinal canal.

(*b*) In the neck immediately upon their exit from between the vertebral transverse processes.

The nerves in the spinal canal were separated from the spinal cord and thoroughly dried, the efficacy of the precautions taken against spread being evidenced by the difference in result obtained by exciting each root.

The effects obtained by the methods *a* and *b* were identical.

Ist Cervical Nerve. Branch of Union with the Hypoglossal.—In the description of the XIIth cranial nerve, we have stated as the result of our experiments that the depressors of the hyoid bone are not thrown into action when this nerve is stimulated within the skull. On carefully dissecting out the branch from the Ist cervical nerve to the hypoglossal we find on excitation of it that there is no movement in the tongue, but the depressors of the hyoid bone are strongly contracted. Of these muscles the sterno-hyoid and sterno-thyroid were always especially affected, while the omo-hyoid was less frequently seen to contract and in some cases not at all. In the cases where this muscle contracted, in one experiment the anterior belly alone acted, and when both bellies contracted the movement in the anterior was in excess of the posterior.

IInd Cervical. Branch to the Descendens Noni.—On stimulating this nerve the depressors of the hyoid were thrown into action, but the muscles involved were not affected in the same way as was the case with the Ist cervical nerve. The muscle which was most constantly set in action by excitation of the IInd cervical nerve was the omo-hyoid and especially its posterior belly. The sterno-hyoid and sterno-thyroid also took part in depressing the hyoid bone, but it was especially remarked in half the cases, that their action was notably less powerful than that of the omo-hyoid. In one experiment in which a very weak current was employed, the omo-hyoid was alone seen to contract. We are consequently led to conclude that while the sterno-hyoid, sterno-thyroid, and omo-hyoid muscles are all set in action by excitation of the Ist and IInd cervical nerves, the first two muscles are relatively supplied by the former nerve, while the IInd nerve is especially connected with the omo-hyoid muscle.

Descendens Noni.—We prefer to mention here the results of exciting this nerve, inasmuch as we regard its motor fibres to be derived entirely from the Ist and IInd cervical nerves. This nerve (ordinarily regarded as a branch of the XIIth cranial), when stimulated above its junction with the branch from the IInd cervical nerve, produced contraction of the sterno-hyoid and sterno-thyroid muscles, and where the current employed was weak there was no contraction of the omo-hyoid, but this movement was superadded on increasing the strength of the current.

We ought here to mention the opinion held by Volkmann (*loc. cit.*) that fibres ascend to the hypoglossal from the spinal rami communicantes by the descendens noni.

IIIrd Cervical Nerve.—On stimulating the branch from this nerve, which forms the IInd cervical nerve just before the ansa thus formed is connected to the descendens noni, there was no action seen in the depressor of the hyoid bone ; it therefore seems certain that these muscles are supplied with motor fibres solely by the branches from the Ist and IInd cervical nerves.

June 14.—"On Meldrum's Rules for Handling Ships in the Southern Indian Ocean." By Hon. Ralph Abercromby, F.R.Met.Soc. Communicated by R. H. Scott, F.R.S.

The results of this paper may be summarized as follows :—

The author examines critically certain rules given by Mr. C. Meldrum for handling ships during hurricanes in the South Indian Ocean, by means both of published observations and from personal inspection of many unpublished records in the Observatory at Mauritius. The result confirms the value of

Mr. Meldrum's rules; and the author then develops certain explanations, which have been partially given by Meldrum, adds slightly to the rules for handling ships, and correlates the whole with the modern methods of meteorology.

As an example, a hurricane is taken which blew near Mauritius on February 11, 12, and 13, 1861, and the history of every ship to which the rules might apply is minutely investigated. The result, dividing Meldrum's rules shortly into three parts, is as follows:—

Rule 1. Lie to with increasing south-east wind till the barometer has fallen 6-10ths of an inch. Seven cases, rule right in every case.

Rule 2. Run to north-west when the barometer has fallen 6-10ths of an inch. Three cases, two failures, one success.

Rule 3. Lie to with increasing north-east or east wind, and a falling barometer. Seven cases, rule right in every instance.

Rule 2 was exceptionally unfortunate in this case, as the path of the central vortex moved in a very uncommon and irregular manner. At the same time, in any case, it appears to be about equally hazardous to follow this rule or to remain hove to.

The following new statements are then examined in detail:—

The shape of all hurricanes is usually oval, not circular. An elaborate examination is made of hurricanes on 60 different days, in 18 different tropical cyclones in various parts of the world, with the following results:—

(1) Out of 60 days, cyclones were apparently circular on only four occasions, and then the materials are very scanty.

(2) The shape was oval on the remaining 56 days, but the ratio of the longer and shorter diameter of the ovals very rarely exceeded 2 to 1.

(3) The centres of the cyclones were usually displaced towards some one side. No rule can be laid down for the direction of displacement, and in fact the direction varies during the progress of the same cyclone. The core of a hurricane is nearly as oval as any other portion.

(4) The longer diameter of the ovals may lie at any angle with reference to the path of the cyclone; but a considerable proportion lie nearly in the same line as the direction of the path.

(5) The association of wind with the oval form is such that the direction of the wind is usually more or less along the isobars, and more or less incurved. This is the almost invariable relation of wind to isobars all over the world.

From an examination of the whole it is proved conclusively that *no rule is possible for determining more than approximately the position of the central vortex of a cyclone by any observations at a single station.*

The relation of a hurricane to the south-east trade is then discussed, and it is shown that there is always what may be called "a belt of intensified trade wind" on the southern side of a cyclone, while the hurricane is moving westwards. In this belt a ship experiences increasing south-east winds and squalls of rain, with a falling barometer, but is not within the true storm field. The difficulties and uncertainties as to handling a ship in this belt are greatly increased by the facts that the longer diameter of the oval form of the cyclones usually lies east and west, and that there is no means of telling towards which side of the oval the vortex is displaced.

The greater incurvature of the wind in rear than in front of hurricanes in the Southern Indian Ocean is next considered, and then facts are collected from other hurricane countries confirmatory of Meldrum's rules for the Mauritius.

Knipping and Doberck in the China Seas find little incurvature of the wind in front, but much in rear of typhoons.

Mr. Willson finds in the Bay of Bengal that north-east winds prevail over many degrees of longitude to the north, *i.e.* in front a cyclone; and this is analogous to the belt of intensified trade so characteristic of Mauritius hurricanes.

Padre Viñez finds at Havana that the incurvature of hurricane winds is very slight in front, and very great in rear.

The author then details further researches on the nature of cyclones, which bear on the rules for handling ships.

(1) Indications derived from the form and motion of clouds. It is shown that the direction of the lower clouds is usually more nearly eight points from the bearing of the vortex than the surface wind; but as the direction varies with the height of the clouds, and as this height can only be estimated, this fact is not of much value.

(2) Looking at the vertical succession of wind currents, if the march of the upper clouds over the south-east trade is more from the east, then the cyclone will pass to the north of the observer: but if the upper clouds move more from the south than the surface wind, then the hurricane will pass to the south of the observer.

(3) As to the form and position of clouds: so soon as the upper regions commence to be covered, the direction in which the cirrus veil is densest gives approximately the bearing of the vortex. Later on, the characteristic cloud bank of the hurricane appears, and the greatest and heaviest mass of the bank will appear sensibly in the direction of the vortex.

The irregular motion of the centre of a cyclone is next discussed, and it is shown that the centre often twists and sways about, in some cases even describing a small loop.

From this and other facts it is shown that the attempts which have been made—

(1) To estimate the track of a cyclone by projection.

(2) To estimate the distance of a ship from the vortex, either by taking into account the entire absolute fall, or by noting the rate of fall, can lead to no useful result.

A series of revised rules for handling ships in hurricanes is given. Comparing these with the older ones it will be remarked—

(1) That the rule for finding approximately the bearing of the vortex is slightly modified.

(2) That the great rules of the "laying to" tacks remain unaltered.

(3) That the greatest improvement is the recognition of the position and nature of the belt of intensified trade wind on the dangerous side of a hurricane, where a ship experiences increasing wind, without change of direction, and a falling barometer. The old idea that such conditions show that a vessel is then *necessarily* exactly on the line of advance of a hurricane is erroneous. She may, but she need not be; and under no circumstances should she run till the barometer has fallen at least 6-10ths of an inch.

(4) There are certain rules which hold for all hurricanes; but every district has a special series, due to its own local peculiarities. Those for the South Indian Ocean are given in this paper.

PARIS.

Academy of Sciences, July 23.—M. Janssen, President, in the chair.—The President announced the death, on July 19, of M. H. Debray, member of the Section of Chemistry, whose name will always be remembered in connection with the laws determining the tension of dissociation, the density of the vapour of sulphur, and other researches throwing much light on many obscure chemical phenomena.—Note on target practice, by M. J. Bertrand. In continuation of his previous communication (*Comptes rendus* of February 6, 1888), the author here shows that the actual results of 1000 experimental shots correspond closely with the theory as expressed by the general equation $k^2x^2 + 2\lambda xy + k'^2y^2 = H$. The practice was at a distance of 200 metres with ten rifles of like model, each marksman firing ten shots with each rifle.—Remarks on the quantitative analysis of nitrogen in vegetable soil, by MM. Berthelot and G. André. The analysis of nitrogen in ground containing nitrates presents some apparent difficulty. But the results of the researches here described show that in the case of ground poor in nitrates, the analysis may be safely and rapidly executed with a blend of lime and soda.—On the luminous bridges observed during the transits and occultations of the satellites of Jupiter, by M. Ch. André. As in the transits of Venus, these optical phenomena are here shown to be entirely due to the optical surfaces of the instruments modifying the direction of the luminous waves. They are, in fact, a result of diffraction in the instruments of observation.—Measurement of the coefficients of thermic conductibility for metals, by M. Alphonse Berget. The author here applies to red copper, brass, and iron, the same method he has already adopted for mercury (*Comptes rendus*, July 25, 1887, and July 16, 1888), with the following results: red copper, $k = 1{\cdot}0405$; brass, $k = 0{\cdot}2625$; iron, $k = 0{\cdot}1587$.—Magnetic determinations in the basin of the West Mediterranean, by M. Th. Moureaux. Having been charged by the Minister of Public Instruction to collect the elements needed for the preparation of magnetic charts for this region, the author obtained in the period from April 19 to June 25, 1887, as many as ninety measures of declination and fifty-nine of inclination for fifty-two stations. The results are here tabulated for these stations, of which four are in Corsica, three in Italy, two in Malta, one in Tripoli, seven in Tunisia, twenty-

five in Algeria, one in Morocco, eight in Spain, and one in France. In a future communication will be given the magnetic charts constructed from these observations.—Analysis of the Nile waters, by M. A. Muntz. At the request of M. Antoine d'Abbadie, the author has examined several specimens with a view to determining the proportion of nitrates contained in these marvellously fertilizing waters. The results show that, while the proportion is variable, it does not exceed or even equal that found in the Seine and some other rivers. The analysis gives 4·02 mgr. per litre for nitric acid, which is derived partly from the soil, partly from the tropical rains which cause the periodical floods. The nitrates are not regarded as the chief cause of the great fertility of Egypt, which is more probably due to the chemical properties of the sedimentary matter deposited at each recurring inundation.—Researches on some salts of rhodium, by M. E. Leidié. The author here determines the constituents and formulas of the chloronitrate of rhodium and ammonia, the sulphate of rhodium sesquioxide, the oxalates of rhodium and potassium, of rhodium and sodium, of rhodium and ammonium, and of rhodium and barium.—On a new method of quantitative analysis for the lithine contained in a large number of mineral waters, by M. A. Carnot. The process here described is effected by means of the fluorides, and is based especially on their different degrees of solubility.—On the chloride, bromide, and sulphide of yttrium and sodium, by M. A. Duboin. The paper deals with the preparation and properties of the crystallized anhydrous chloride and bromide of yttrium, and the crystallized sulphide of yttrium and sodium.—On the quantitative analysis of glycerine by oxidation, by M. Victor Planchon. A detailed account is given (with further applications) of Messrs. Fox and Wanklyn's new process of analysis, based on the fact that glycerine, oxidized by the permanganate of potassa in a strong alkaline solution, is transformed to water, carbonic acid, and oxalic acid, according to the equation given in the *Chemical News* of January 8, 1886.—On anagyrine, by MM. E. Hardy and N. Gallois. The authors claim to have first discovered this extract of *Anagyris fœtida*, a poisonous leguminous plant ranging over the whole of the Mediterranean basin. They here describe its toxic properties, and determine the formula of anagyrine as $C_{14}H_{18}N_2O_2$.—Action of aniline on epichlorhydrine, by M. Ad. Fauconnier. Some months ago the author announced that he had obtained by the action of aniline on epichlorhydrine an oleaginous base, the chlorhydrate of which corresponds to the formula $C_{15}H_{20}N_2Cl_2O$. He has since prepared this base in the crystallized state, and has also obtained some derivatives, which have enabled him to determine its constitution and true formula, $C_3H_5(OH)(NH.C_6H_5)_2$. Instead of dianilglycerine, as first suggested, he now proposes to call this base oxipropylene-diphenyldiamine, which has the advantage of indicating its composition.—M. Pierre Zalocostas describes the constitution of spongine; MM. Arm. Gautier and L. Mourgues deal with the volatile alkaloids of cod-liver oil (butylamine, amylamine, hexylamine, dihydrolutidine); M. Massol gives a process for neutralizing malonic acid by means of the soluble bases; and M. H. Moissan describes the method of preparation and the properties of the fluoride of ethyl.

BERLIN.

Physiological Society, July 20.—Prof. du Bois-Reymond, President, in the chair.—Dr. Benda explained his views on the structure of striated muscle-fibres in connection with the statements recently laid before the Society by van Gehnchten. He took as his starting-point the wing-muscles of insects, which are composed of fibrillæ permeated by transverse partitions; each division of the fibre consists of a hollow cylinder of isotropic substance filled with contractile anisotropic material. The latter shrinks under the influence of reagents, leaving above and below a disk of isotropic substance. In the muscles of the body in insects, and in those of the higher animals, the isotropic disks of neighbouring fibrillæ are fused into continuous layers, between which the small cylinders of anisotropic substance run perpendicularly. When the muscles are resolved by the action of reagents into Bowman's disks, the cleavage of the fibrils takes place either across the anisotropic cylinders or the isotropic disks.—Dr. Heymans spoke on the relative toxicity of oxalic, malonic, succinic, and methyl-succinic acids, and of their sodium salts. He had been requested by Prof. Henry, who had studied the chemical and physical properties of these acids, to investigate the relative toxic action of this series of acids, and had found that the strongest acid—namely, oxalic—was the most poisonous. One milligramme of this acid sufficed to kill a frog; of malonic acid, whose physiological action, as well as that of methyl-succinic acid, had not been investigated, 2 to 3 mgr. were necessary; of succinic acid, 3 to 4 mgr.; and of methyl-succinic acid, 6 to 7 mgr. The toxic action of the acids diminished thus as the molecular weight increased. When the sodium salts of these acids were used instead of the free acids, the toxicity was the same in the case of oxalic acid, but was much less in the case of the other three acids.—Dr. Sklarek gave an account of the recently published observations of Weismann and Ischikawa on partial impregnation of the Daphnidæ.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Symons's British Rainfall 1887: G. J. Symons (Stanford).—Mediæval Researches from Eastern Asiatic Sources, 2 vols.: E. Bretschneider (Trübner).—My Microscope, second edition: by a Quekett Club Man (Roper and Drowley).—The Fauna of British India, Mammalia: W. T. Blanford (Taylor and Francis).—Schriften der Physikalisch-Ökonomischen Gesellschaft zu Königsberg i. Pr., 1887 (Königsberg).—Maps Nos. 3 to 7 to accompany Annual Report of the Geological and Natural History Survey of Canada, vol. ii. 1886 (Dawson, Montreal).—Fauna der Gaskohle und der Kalksteine der Permformation Böhmens; Band ii. Heft 3, Die Lurchfische, Dipnoi: Dr. Ant. Fritsch (Prag).—Beobachtungs-Ergebnisse der Norwegischen Polarstation Bossekop in Alten, ii. Theil (Grondahl, Christiania).—The Education of the Imagination: C. H. Hinton (Sonnenschein).—Many Dimensions, C. H. Hinton (Sonnenschein).—Die Süsswasserbryozoen Böhmens: J. Kafka (Prag).—Archives Italiennes de Biologie, Tome x. Fasc. i. (Turin).—Journal of the Trenton Natural History Society, No. 3 (Trenton, N.J.).—Bulletin de la Société Impériale des Naturalistes de Moscou, No. 2, 1888 (Moscou).—Transactions of the New Zealand Institute, vol. xx., 1887.

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